











# THE NEW INTERNATIONAL ENCYCLOPÆDIA

SECOND EDITION

VOLUME VII

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## KEY TO PRONUNCIATION

For a full explanation of the various sounds indicated, see the KEY TO PRONUNCIATION in Vol. I.

ā	as in ale, fate.	ch	as in chair, cheese.
ā	" " senate, chaotic.	d	" " Spanish Almodovar, pulgada, where it is nearly like <i>th</i> in English then.
ā	" " glare, care, and as <i>e</i> in there.	g	" " go, get.
ā	" " am, at.	g	" " German Landtag = <i>ch</i> in Ger. ach, etc.
ā	" " arm, father.	h	" <i>j</i> in Spanish Jijona, <i>g</i> in Spanish gila; like English <i>h</i> in hue, but stronger.
ā	" " ant, and final <i>a</i> in America, armada, etc.	hw	" <i>wh</i> in which.
ā	" " final, regal, pleasant.	k	" <i>ch</i> in German ich, Albrecht = <i>g</i> in German Arensburg, Mecklenburg, etc.
ā	" " all, fall.	ŋ	" in sinker, longer.
ā	" " eve.	ng	" " sing, long.
ā	" " elate, evade.	n	" " French bon, Bourbon, and <i>m</i> in the French Étampes; here it indicates nasalizing of the preceding vowel.
ā	" " end, pet.	sh	" " shine, shut.
ā	" " fern, her, and as <i>i</i> in sir, etc.	th	" " thrust, thin.
ā	" " agency, judgment.	th	" " then, this.
ā	" " ice, quiet.	zh	" <i>z</i> in azure, and <i>s</i> in pleasure.
ā	" " quiescent.		
ā	" " ill, fit.		
ā	" " old, sober.		
ā	" " obey, sobriety.		
ā	" " orb, nor.		
ā	" " odd, forest, not.		
ā	" " atom, carol.		
oi	" " oil, boil.		
ō	" " food, fool, and as <i>u</i> in rude, rule.		
ou	" " house, mouse.		
ū	" " use, mule.		
ū	" " unite.		
ū	" " cut, but.		
ū	" " full, put, or as <i>oo</i> in foot, book.		
ū	" " urn, burn.		
y	" " yet, yield.		
ʙ	" " Spanish Habana, Córdoba, where it is like English <i>v</i> but made with the lips alone.		

An apostrophe ['] is sometimes used as in tā'b'l (table), kǎz'm (chasm), to indicate the elision of a vowel or its reduction to a mere murmur.

For foreign sounds, the nearest English equivalent is generally used. In any case where a special symbol, as *g*, *h*, *k*, *x*, is used, those unfamiliar with the foreign sound indicated may substitute the English sound ordinarily indicated by the letter. For a full description of all such sounds, see the article on PRONUNCIATION.

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# THE NEW INTERNATIONAL ENCYCLOPÆDIA

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**DIDYMUS** (Lat., from Gk. *δίδυμος*, twofold, twain). The Greek translation of the Aramaic *tō'mā'* (Heb. *t'ōm*), a twin, of which *Θώμας*, *Thōmas*, is the transliteration. It is the alternative name given in the Fourth Gospel (xi. 16; xx. 24; xxi. 2) to one of the disciples of Jesus. Eusebius (*Hist. Eccl.*, i. 13) states that his primary name was Judas, in which case his alternative name would be given him to distinguish him from Judas, the son of James, and from Judas Iscariot (cf. Luke vi. 16). It is of interest to note that the Sinaitic-Syriac manuscript in John xiv. 22 reads "Thomas [instead of Judas], not Iscariot."

**DIDYMUS** (Lat., from Gk. *Δίδυμος*) (63 B.C. -?). An Alexandrian grammarian of the time of Augustus, famous as author of an enormous number of books, in which he incorporated the works of his predecessors. The total number of his works is given as 3500 by Athenæus and Suidas, by Seneca as 4000. These include commentaries on Homer, Hesiod, Pindar, Bacchylides, Æschylus, Sophocles, Euripides, Eupolis, Cratinus, Aristophanes, Menander, Antiphon, Isæus, Æschines, Demosthenes, Hyperides, and many others. The extant scholia to Homer, Pindar, Sophocles, Euripides, and Aristophanes, in great measure, go back to his commentaries. He published also lexicographical collections on the poets, historians, and orators; wrote on all kinds of questions concerning literary history and composition; and composed historical and antiquarian treatises. From his endless industry he was nicknamed Chalcenteros (*Χαλκέντερος*), 'Brazen-Bowelled.' Among the Romans he was in such high repute that Macrobius called him the most learned grammarian of his own or other times. Consult: Schmidt, *Didymi Chalcenteri Fragmenta* (Leipzig, 1854); Ludwich, *Aristarch's Homerische Textkritik nach den Fragmenten des Didymus* (ib., 1884-85); Wilamowitz, *Herakles*, vol. i (Berlin, 1889); Susemihl, *Geschichte der griechischen Litteratur in der Alexandrinerzeit*, vol. ii (Leipzig, 1892); Sandys, *A History of Classical Scholarship*, vol. i (2d ed., Cambridge, 1906).

**DIDYMUS OF ALEXANDRIA** (309-394). An ecclesiastical writer. Although he became blind at the age of four, before he had learned to read, he succeeded in mastering all the sciences then known, and on his ordination was placed by Athanasius at the head of the

Alexandrian school of theology. He was a man of great earnestness and piety. Most of his works are lost, but we possess a translation by Jerome (one of his pupils) of his treatise on the Holy Ghost, and a translation by Epiphanius of his comments on the canonical Epistles. A treatise on the Trinity and one against the Manichæans are also extant in Greek. He was condemned by the sixth (680) and seventh (787) ecumenical councils as an Origenist. His works are in Migne, *Patrologia Græca*, xxxix.

**DIE.** See DICE; DIES AND DIE SINKING.

**DIEBITSCH**, dē'bich, HANS KARL FRIEDRICH ANTON, COUNT (1785-1831). A Russian field marshal. He was born at Grossleippe, Silesia, and at an early age entered the Russian army. After serving with distinction at Austerlitz, Eylau, and Friedland, and attaining the grade of captain, he devoted a number of years to the study of military science. In 1812 he distinguished himself greatly by recapturing Polotsk and covering the retreat of Wittgenstein's corps. He was then raised to the rank of major general, and shortly afterward, in 1813, after negotiating the Convention of Tauroggen, he was sent into Silesia to serve with General Yorck in the War of Liberation, during which time he shared in the negotiations of Reichenbach. After the battle of Leipzig he was made lieutenant general. In 1814 he urged the march of the Allies on Paris, for which the Emperor conferred on him the order of St. Alexander Nevski. In 1815 he attended the Congress of Vienna and was made adjutant general to the Emperor. He was present at Alexander's death at Taganrog. The Emperor Nicholas made him Baron and afterward Count. In the Turkish War of 1828-29 he had the chief command, took Varna, crossed the Balkans, and made peace at Adrianople. The crossing of the Balkan Mountains was commemorated in the addition of Zabalkanski, 'Crosser of the Balkans' (Russ. *za*, beyond + *Balkany*, the Balkans), to his name and his elevation to the rank of field marshal. On the outbreak of the Polish Revolution in 1830 he was given the chief command, but did not meet with his usual success. He died near Polotsk, June 10, 1831, probably of cholera. Consult Belmont, *Graf Diebitsch* (Dresden, 1830), and Chesney, *Russo-Turkish Campaigns 1828-29* (New York, 1856).

**DIEDENHOFEN**, dē'den-hō'fen (Fr. *Thion-*

ville). A town of Alsace-Lorraine, in the District of Lorraine, Germany, on the Moselle, 22 miles north of Metz (Map: Germany, B 4). Its old fortifications, of little value on account of the eminences commanding them, were razed in 1903 and the ground laid out in streets. It is the centre of the iron industry of Lorraine, and there is a considerable trade in fruit, vegetables, grain, wine, and wood. Pop., 1900, 10,060; 1910, 14,184. Diedenhofen, known by the name of Theodonisvilla, in the eighth century, was frequently the residence of the Carolingian rulers. It came into the possession of France in 1683 and of Germany in 1871.

**DIEFENBACH**, dē'fen-bäg, LORENZ (1806-83). A German philologist. He was born at Ostheim, Grand Duchy of Hesse, studied theology and philosophy at Giessen, traveled much, and for 12 years was pastor and librarian at Solms-Laubach. He was one of the founders of the German-Catholic party and in 1848 was a deputy from Offenbach to the Parliament of Frankfurt-on-the-Main. He remained in that city and in 1865 was appointed second municipal librarian. His literary industry was enormous, and his writings include poetry and romance as well as learned philosophical treatises. His principal works are: *Celtica* (3 vols., 1839-40); *Vergleichendes Wörterbuch der gotischen Sprache* (2 vols., 1846-51); *Glossarium Latino-Germanicum Mediae et Infimae Aetatis*, a supplement to Ducange's well-known Glossary (1857); *Origines Europææ* (1861); *Hoch- und niederdeutsches Wörterbuch*, with E. Wülcker (2 vols., 1874-85).

**DIEFFENBACH**, GEORG CHRISTIAN (1822-1901). A German theologian and poet, born at Schlitz, Hesse. He studied at Giessen and in 1871 became chief pastor in Schlitz. His liturgical, poetical, devotional, and homiletic publications are numerous and highly popular, more especially his poems for children.

**DIEFFENBACH**, JOHANN FRIEDRICH (1795-1847). A German surgeon, born in Königsberg, Prussia. After studying at Bonn and elsewhere, and traveling in France, he took his degree in 1822 and commenced practice in Berlin, where he soon attained distinction as an operator, and in 1840 was promoted to be professor and director of clinical surgery. Besides possessing skill in all the usual operations with the knife, Dieffenbach introduced many improvements, particularly in the art of forming new noses, lips, eyelids, and in other plastic operations. He was the author of *Die transfusion des Blutes und die Einspritzung der Arzneien in die Adern* (1828); *Chirurgische Erfahrungen* (4 vols., 1829-35); *Ueber die Durchschneidung der Sehnen und Muskeln* (1841); *Die Heilung des Stotterns* (1841); *Ueber das Schielen* (1842); *Die operative Chirurgie* (12 vols., 1844-48).

**DIEGUEÑOS**. A group of Mission Indians (q.v.) living on small reservations near San Diego, Cal. See YUMAN STOCK.

**DIELECTRIC AND DIELECTRIC CONSTANT**. See ELECTRICITY.

**DIELMAN**, dēl'män, FREDERICK (1847- ). An American painter, designer, illustrator, and educator. He was born in Hanover, Germany. He was brought to the United States in infancy, passed his youth in western Maryland, and was educated at Calvert College, Baltimore. From 1866 to 1872 he was a topographer and draftsman in the United States Engineering Department. He then studied

painting with Wilhelm Diez at the Royal Academy of Munich and established a studio in New York in 1876. He soon became known for his charming and minutely executed genre pictures, such as the "Patrician Lady" (T. P. Williams, New York); "My Own Puss" (B. Clarke, New York); "L. . . . . Young Gambler" ( . . . . . against leafy . . . . . in designing illustrations for collective editions of standard authors and of late years executed designs for mosaic and mural paintings, such as the mosaic panel "Thrift," in the Albany Savings Bank, those of "History" and "Law" in the Congressional Library, Washington, and six mosaics in the Iowa State Capitol, Des Moines. At the St. Louis Exposition he exhibited a series of designs for mural paintings and two aquarelles. He was one of the founders of the Society of American Artists, was elected in 1883 to the National Academy of Design, of which he was president in 1899-1909. Under his able administration the Academy expanded, and its influence greatly increased. As professor of drawing in the College of the City of New York after 1903 and director of the Art Schools of Cooper Union he exercised an important educational influence, and he also took a prominent part in movements to promote art, such as the Fine Arts Federation of New York, of which he became president. He was elected a member of the National Institute of Arts and Letters.

**DIELS**, dēls, HERMANN (1848- ). A German classical scholar, appointed professor ordinarius of classical philology at the University of Berlin in 1886. He was born at Biebrich on the Rhine and was educated at the universities of Bonn and Berlin. In addition to his most notable work, *Doxographi Graeci* (1879), in which the sources of the doctrines of Greek philosophers as transmitted by post-Aristotelian scholars were for the first time determined, his works include an edition of Simplicius' *Commentary on the Physics of Aristotle* (*Simplicii in Aristotelis Physica Commentaria*, 1882); *Ueber die Philosophenschulen der Griechen* (1887); *Die Fragmente der Vorsokratiker, Griechisch und Deutsch* (1903; 2d ed., 1906-10); and a treatise on the *Sibyllinische Blätter* (1890). He was one of the editors of the *Archiv für Geschichte der Philosophie* (Berlin), begun in 1887, and of the *Commentaria in Aristotelem Graeca*.

**DIEL/YTRA**. See DICENTRA.

**DIÉMER**, dyä'mär', LOUIS (1843- ). A French pianist and composer, born in Paris. He studied at the conservatory under A. Thomas, Marmontel, Benoist, and Bazin, carrying off the first prize for piano playing when only 13 years old. In 1888 he succeeded Marmontel as professor of piano at the conservatory. His series of historical piano recitals during the Exposition of 1889 created such widespread interest that he devoted himself almost exclusively to the older piano music and founded the Société des anciens instruments. He published a valuable collection of *Clavicinistes français*. His original compositions include a piano concerto in C m., a concertstück for piano and one for violin, some excellent chamber music, and numerous works for piano.

**DIEPENBEECK**, dē'pen-bäk, ABRAHAM VAN (1596-1675). A Flemish painter and designer for line engravings and stained glasses. He was

born in Bois-le-Duc, studied under his father, a glass painter, and came to Antwerp about 1623. There he designed a number of important glass windows, some of which survive in the cathedral of Antwerp, St. Jacob's Church, and elsewhere. In 1641 he was elected dean of St. Luke's Guild, Antwerp. Many pictures in various museums and churches have been ascribed to him, but only two (the "Martyrdom of St. Julia," and the "Virgin of the Apocalypse" in the Uffizi, formerly attributed to Van Dyck) are absolutely authentic. Others, such as "St. Norbert," in the cathedral at Antwerp; the "Consecration of St. Norbert" in the church of Deurne, and the "Distribution of Alms" (Pinakothek, Munich), are probably by him. On the other hand, the "Flight of Clœlia" and the "Marriage of St. Catharine," in Berlin, and kindred paintings, formerly attributed to him, are repudiated by modern critics. He made numerous drawings for the Duke of Newcastle and painted his portrait, from which it is assumed that he visited England. He was connected with the Plantin printing establishment and designed about 500 plates of a rather inferior quality.

**DIEPPE**, dyĕp (connected with AS. *dype*, Dutch *diep*, depth). A seaport in the Department of Seine-Inférieure, France, at the mouth of the river Arques, on the English Channel, 33 miles north of Rouen (Map: France, N., G 3). Dieppe is situated between two high ranges of chalk cliffs, and is a fairly modern city; the houses are built for the most part of stone and brick, with high, slanting roofs. The fifteenth-century castle, now used as a barracks, occupies a high cliff at the west end of the town. The old harbor is situated to the northeast, and admits vessels of 500 tons' burden, but a new channel with its own harbor system has been added, and vessels of 20-foot draft can now enter. Connected by a drawbridge is the little fishing suburb of Pollet, uninviting, but interesting in that the inhabitants, differing from the rest of Upper Normandy, are supposed to be descendants of Saxons who settled on the French coast during the Merovingian period. Among the principal buildings are the churches of Saint-Jacques of the twelfth century, and Saint-Remy of the late sixteenth century, a museum and picture gallery, and the theatre. Dieppe is one of the principal watering places of France and attracts many visitors in summer. It has a communal college and a school of navigation. It is one of the chief import points for English coal. It has daily steamer service to Newhaven on the English coast. The manufactures are lace, cotton goods, porcelain, lumber, fine linen, tobacco, paper and carved articles of horn, bone, and ivory. There are also ship-building yards, sugar refineries, and distilleries. The fishing fleet of Dieppe is large and important. Pop., 1901, 22,839; 1911, 23,973. In 1442 Dieppe held out successfully against a besieging force of English under Talbot. Its merchants were early noted for their enterprise, and ships from this port visited Brazil and the East Indies in the sixteenth century. In 1694 it was bombarded by the English and Dutch fleet and utterly demolished. Since that time it has been outdistanced as a port by Havre. Consult *Guide au Dieppe et environs* (Dieppe, 1865), and D. Asseline, *Les antiquités et chroniques de la ville de Dieppe* (Paris, 1874).

**DIERVILLA**, di'ēr-vī'lā. See WEIGELA.

**DIERX**, dé'ēr', LÉON (1838- ). A French poet born on the island of Réunion and educated at Paris. He became a member of the Parnassians. He published: *Aspirations* (1858); *Poèmes et poésies* (1864); *Les lèvres closes* (1867); *Les paroles du vaincu* (1871); *La recontre* (1874); *Les amants* (1879). His collected poems (1889-90) were crowned by the Academy.

**DIES AND DIE SINKING** (OF. *de, det*, Fr. *dé*, Sp., Portug., It., *dado*, die, from Lat. *datus*, p.p. of *dare*, to give). The art of making and using dies for stamping coins is of very ancient origin. Old coins have been found which show that it was known to the Greeks at least 800 B.C. The use of dies for stamping, shaping, and cutting out metals and other materials is of much more recent origin and reached its present development only in the closing years of the eighteenth century. The use of the punch and press for cutting metal forms is said to have been practiced in a crude way by a German blacksmith of the fifteenth century. Presses for shaping as well as cutting metal were invented by T. Griffiths, of England, in 1841, but they were developed in France, where they were applied to the production of kitchen utensils. More recently presses have been utilized in many other branches of manufacture besides those dealing with metals. The use of dies, e.g., plays an important part in the modern shoe factory and, in fact, in all industries where a given form has to be produced repeatedly, whether the material be metal, leather, cloth, or paper. The most recent development in the art of using dies has been in the direction of working cold steel into numerous complicated forms, which were formerly produced only by casting and forging.

The astonishing cheapness of numerous sheet-metal products is mainly due to the use of dies, which accomplish by a single stroke the work which formerly required long and tedious manipulation. A striking example is the modern bicycle or typewriter, a large proportion of whose many hundred parts are formed by the power press. Not only kitchen utensils, but jewelry, boxes, pens, buttons, and the thousand and one familiar objects which were formerly worked into shape with the hammer, or soldered together out of separate pieces, are now struck between two dies of suitable form.

Dies, in general, are in pairs, consisting of a male die, or punch, and a female die, which are so adjusted on a power press that one fits accurately into the other. Often, however, in cutting the less resistant materials, as leather, cloth, or paper, the two parts of the typical die are not required. The punch is simply forced by a power hammer through the materials against a flat surface. In an article in the *Engineering Magazine* (New York) for March, 1898, on "The Development of Machinery for Sheet-Metal Stamping," Oberlin Smith divides the kinds of work done by stamping into four general classes: "(1) cutting, in which are included punching and shearing; (2) forming, including bending, embossing, and curling; (3) drawing and redrawing, which are more than forming, since the metal is subjected to an extensive distortion or molecular flow, incident to the changing of a flat, annular disk into a cylindrical, or conical, or hemispherical form of smaller average diameter, its surface being meanwhile rigidly confined to prevent

wrinklings; (4) coining, with which should be included drop forging, the metal in both cases being treated as a liquid and simply pumped, as it were, into the shape desired, the molecular flow being very great, and the whole object being treated as is a pat of butter or a cake of soap in the molds provided for its new incarnation."

The simplest forms of cutting dies are the *blanking dies*, used for cutting out flat blanks from steel, iron, or other material. A shear edge is given either to the punch or to the die, according to the work to be performed. When, as in cutting buttons, it is the blanks that are to be used, the shear edge is given to the die; but when the hole is the object sought, as in making rivet holes in boiler plates, the shear is given to the punch. *Compound cutting dies* are used for cutting fine work, where the relation of the centre or other holes to the outside must be perfect, as in blanks for watch and clock movements, and sheet-iron disks for the armatures of dynamos and electric motors. A compound die has for its upper half a punch set into a die and for its lower half a die set into a punch; one stroke of the press thus performs the work that would require two or more operations if done on plain dies. *Needle dies* are used for punching eyes in needles. The die is made in three pieces, securely fastened together. The centre piece projects above the surface of the two side pieces and into the groove of the needle. Thus, the needle is supported while being punched. This centre piece has a U-shaped slot, equal in width to the length of the eye of the needle. The press is so arranged that the needle is first stamped and then punched, the speed of the punch at the moment it enters the eye of the needle being very slow.

*Bending dies* are simple when the metal is bent at a single angle, and complex when a loop is required, as in making armature connections, safety pins, and the like. *Drawing dies* are dies which are used for "drawing up" or shaping metal into such forms as basins, thimbles, and bells. In some complex dies the metal is shaped, stamped with a design, and cut, all by a single stroke of the press, as in making blacking-box covers. Very often, however, in producing the more complicated forms of drawn work, the object is put through several dies before it attains its completed shape. The crank hanger of an ordinary bicycle has to pass through a dozen or more presses before the flat sheet of steel is transformed into the piece of complicated tubing required. But even then the process of cutting and bending cold steel by means of power-driven dies is much less expensive than the old method of forging such parts roughly into shape, drilling out the cavities, and turning and polishing the surfaces.

Considering now the use of dies for stamping figures on metallic surfaces, as coins and medals, it is found that the preliminary process of die sinking is an elaborate one. It requires great skill and gives opportunity for the display of artistic feeling and talent as well. Die-sinking is a branch of engraving, but it involves the use of other tools besides those of the engraver. A piece of softened steel, called the hub, is prepared, and on its end the design is cut. The steel is then hardened and forms the *matrix*. The design on the matrix is impressed upon another plug of softened steel,

with the result that the design, wrought in intaglio on the matrix, comes out in relief on the second piece of metal, which is called the *punch*. The punch, in turn, is hardened and used to impress the design upon a third piece of metal. This third piece is of course an exact duplicate of the matrix and forms the die to be used for stamping coins. The original matrix upon which the design was engraved is not used for stamping coins, because the expense of engraving is very great, and the life of a die is short, but is saved for making more dies. One step in the process outlined may be saved by engraving the design, in relief, in the first place so that the punch made from this design in intaglio can be used as a die for coining or . . . . .

Consult: Lucas, *Dies and Die Making* (Providence, R. I., 1897), a practical treatise on making dies; Woodworth, *Dies: Their Construction and Use* (New York, 5th ed., 1907); id., *Drop Forging, Die Sinking and Machine Forming of Steel* (ib., 1911). The article by Oberlin Smith (see above) contains an admirable résumé of the results obtained by this method of m . . . . . MINT.

DIE'S COWTIALIS See FASTI.

DIESEL, dē'zel, RUDOLF (1858-1913). A German inventor, born in Paris. He studied in England and at the Polytechnic School in Munich, where, after an interval as manager of a Paris refrigerating company, he settled (1895). In 1893 his proposal to utilize directly the energy created by the combustion of fuel created a sensation, and although his plan was proved impractical, yet it led to his invention of the Diesel engine (see INTERNAL-COMBUSTION ENGINES), the success of which he demonstrated in 1897. He lectured in the United States in 1912 and in 1913 was called to England for consultation with the British Admiralty on the application of his motors; but in crossing the Channel he was drowned. There is a translation by Bryan Donkin from the German of Diesel's . . . . . of 1893 under the title *Theory and Construction of a Rational Heat Motor* (1894). Diesel also published *Die Entstehung des Dieselmotors* (1913).

DIESEL ENGINE. See INTERNAL-COMBUSTION ENGINES.

DIES FASTI. See FASTI.

DIES FISSI. See FASTI.

DIES INTERCISI. See FASTI.

DIES IRÆ, dī'ez ī'rē (Lat., day of wrath). The name generally given (from the opening words) to one of the most famous mediæval hymns. The first 17 of its 19 stanzas are in triplets of rhyming trochaic tetrameters; it describes the Last Judgment in language of magnificent grandeur and then passes into a plaintive plea for the souls of the departed. The first stanza is—

"Dies iræ, dies illa,  
Solvat sæculum in favilla:  
Teste David cum Sibylla."

Daniel, who calls it "the chief glory of sacred poetry," and other eminent authorities agree in assigning its authorship to the Franciscan Thomas of Celano (died c.1255). It found its way gradually into various diocesan missals and was prescribed for universal use in the revised edition of the Roman missal put forth by Pius V in 1570. It is one of only five sequences which have been retained in modern usage and

is sung on All Souls' Day and at other masses for the dead. It was translated into English by Crashaw and Dryden in the seventeenth century and by Macaulay, Isaac Williams, Dean Stanley, and others in the nineteenth. There are said to be 234 English renderings. Perhaps the best version, as well as the most familiar, is that by W. J. Irons. Scott introduced the opening stanzas into his "Lay of the Last Minstrel," and an effective use, heightened by Gounod in his opera, is made of it by Goethe in *Faust*.

**DIESKAU**, dē'skau, KARL WILHELM (1701-77). A German soldier, born at Dieskau. He entered the artillery in 1721, fought in 12 campaigns, and rose to be a lieutenant general. He made many important improvements in the artillery and under commission of Frederick the Great invented a light cannon known by his name. Consult the *Biography* by Meier (Berlin, 1889).

**DIESKAU**, LUDWIG AUGUST, BARON (1701-67). A German officer in the French service, distinguished in the French and Indian War in America. He was born in Saxony, was an adjutant to Marshal Saxe, served under him in the Netherlands, and in 1748 was raised to the rank of brigadier general. In 1755 he went to America as major general, to command French troops in the French and Indian War, and in August took the field at the head of 3573 men. Early in September he started for Fort Lyman (afterward Fort Edward) at the head of 216 regulars, 684 Canadians, and about 600 Indians, but afterward changed his plans and moved against Fort George. On September 8, 3 miles from Fort George, he ambushed and completely defeated a detachment of 1000 men sent against him; but, deserted by the Indians and many of the Canadians, he was himself totally defeated before the fort by the terrible fire of a force of English colonists under Sir William Johnson. He was wounded, taken prisoner, held until 1763, and died of the effects of the wound. For his military career in America, consult Parkman, *Montcalm and Wolfe* (2 vols., Boston, 1884).

**DIES NEFASTI**. See **FASTI**.

**DIES NON**, dī'ez nōn (Lat., abbreviated from the phrase *dies non juridicus*, not a court day). A nonjuridical day, i.e., a day on which the business of the courts in the administration of justice cannot lawfully be carried on. At the common law Sundays and certain other peculiarly sacred days were of this character, as Ascension Day, All Saints' Day, Christmas Day, etc. In the United States certain secular holidays are included in the description of nonjuridical days, as well as Sunday, but not all legal holidays, nor all days on which the courts do not sit. A day may be juridical, i.e., open to legal process and the administration of justice, even though it be a legal holiday in the usual acceptance of that term, and the courts be not regularly in session. Christmas Day is universally a *dies non*, and in some jurisdictions Thanksgiving or Fast Day and Independence Day. But the day of the general election, the Saturday half-holiday, and "bank holidays" generally are law days. Nor does the fact that certain legal acts, as the giving of a promissory note or its presentment for payment, are prohibited on a certain day affect its juridical character. It is only the virtual suspension of the operations of justice which gives a day

the character of a *dies non*, and the policy of the law does not favor the multiplication of such days.

But this paralysis of judicial administration has never been complete. There have always been exceptions to the rule, even in the law courts, and in the early history of equity jurisdiction the chancellor was restrained only by his own sense of what the sanctities of a holy day seemed to require. To-day the equitable as well as the common-law jurisdiction of the courts is suspended on nonjuridical days, and ordinarily there can be no valid issue or service of process of any kind on such days; but it is everywhere held that the court may sit for the purpose of receiving the verdict of a jury, and that warrants for treason, felony, and breach of the peace may issue and be executed on any day; and in general, when public policy or the prevention of irremediable wrong requires it, the courts may sit on Sunday or any other nonjuridical day and issue process.

While the doctrine under consideration is of common-law origin, it is now mainly regulated by statute, and the laws defining it usually declare in express terms what juridical acts can and what cannot be lawfully performed on a *dies non*. As to the distinction between judicial and ministerial acts performed on such a day, consult 9 Coke's *Reports*, 66, and 5 *Central Law Journal*, 26. On the general subject consult 7 *Southern Law Review*, N. S., 697. See also **DAY**; **HOLIDAY**; **SUNDAY**.

**DIES RELIGIOSI**. See **FASTI**.

**DIESTERWEG**, dē'stēr-vāk, FRIEDRICH ADOLF WILHELM (1790-1866). A noted German educator. He was born at Siegen, Prussia, and in 1808-11 studied at Herborn and Tübingen. He taught at Mannheim and at Worms until 1813, was called to the Model School at Frankfurt, was rector of the Latin School, Elberfeld, and in 1820 became director of the new Teachers' Seminary at Mörs, where he laid the foundation of his great reputation as a teacher and educational writer. This led to his appointment, in 1832, as director of the Seminary for City School Teachers in Berlin, from which post he retired in 1847, after having for years been involved in serious disagreements with the authorities regarding his reformatory views in connection with the most important phases of higher education. He was pensioned by the government in 1850 and thenceforth propagated his ideas only by his literary efforts. He was elected to the Prussian Diet in 1858. Diesterweg stands in the foremost rank among modern educators and has rendered the greatest service to education by his training of teachers. As a follower of Pestalozzi, he aimed at making every subject of instruction a means of education and by his own example as well as through his writings has exercised a far-reaching influence on the development of his method in the various branches of instruction. He advocated his pedagogical views in the *Rheinische Blätter für Erziehung und Unterricht*, founded by him in 1827, and afterward also in the *Pädagogisches Jahrbuch*, which he established in Berlin in 1851. Among his numerous writings some of the most noteworthy are: *Wegweiser zur Bildung für deutsche Lehrer* (2 vols., 1834; 6th ed., 1 vol., 1890); *Das pädagogische Deutschland* (1836); *Streitfragen auf dem Gebiete der Pädagogik* (1837); *Leitfaden für den Unterricht in der Formlehre*

(1845); *Lehrbuch der mathematischen Geographie* (1840: 18th ed., under new title, *Populäre Himmelskunde*, 1891); *Unterricht in der Kleinkinderschule* (5th ed., 1852). Consult: Adolf Rebhuhn, *Briefe Adolf Diesterwegs* (Leipzig, 1907); Otto Gerstenhauer, *Adolf Diesterwegs Wegweiser zur Bildung für deutsche Lehrer* (Breslau, 1908); Karl Richter, *Adolf Diesterwegs Ansichten über pädagogische Zeit- und Streitfragen* (Leipzig, 1913).

**DIET** (OF. *dieta*, Fr. *diète*, It., Portug., Sp. *dieta*, from Lat. *dieta*, Gk. *diata*, *diaita*, daily regimen). The food substances habitually taken into the body, so as to repair the waste of tissue and provide for growth and development. The diet of different human races is quite different in character. The Eskimos, the Kirghiz, and certain other tribes live exclusively on meat. On the contrary, the Hindus and others subsist almost exclusively upon vegetables. But the most intellectual and successful of the human races have lived on a mixed diet. In health the diet should be composed of both easily digested food and food difficult of digestion, to be varied according to the amount of exercise taken, the climate, and the occupation.

**Diet in Health.** The standard of Voit, of Munich, has long been accepted as the daily diet most suitable to a healthy man of average requirements, doing an average amount of work: 118 grams of proteids, 56 grams of fat, and 500 grams of carbohydrate, to which must be added 30 grams of salt and 3 liters of water. Chittenden has demonstrated, however, that from 5 to 9 grams of proteids a day preserves the nitrogen equilibrium for college professors, members of the United States Army Hospital Corps, and for trained athletes actually competing in contests.

In estimating the available quantities of these nutrients in a given article of food, it is of course necessary to take into account the factor of digestibility. See **Food**.

**Diet in Institutions for the Insane.** Dr. Austin Flint, of New York, prepared for use in the State hospitals for the insane a diet list which has met the requirements of such institutions for many years, with some modifications according to special indications at certain seasons or in certain localities, and supplemented with special diet in cases of special need, as determined by the physicians in charge. According to this, the following is the daily allowance for each individual:

Meat with bone, including salted meats, fresh and salted fish, and poultry	12 oz.
Flour, to be used in making bread and in cooking (may in part be substituted by cornmeal and macaroni)	16 oz.
Potatoes	8 oz.
Milk	8 oz.
Two eggs	4 oz.
Sugar	2 oz.
Butter	2 oz.
Cheese	2 oz.
Rice, hominy, . . . . .	1½ oz.
Beans or peas	1½ oz.
Coffee (green).....	1 oz.
Tea (black).....	½ oz.

**Diet in Old Age.** In old age there is less demand for food to provide energy, and consequently less nourishment should be taken. It is generally agreed that, given a fair constitution, the use of a physiological diet promotes longevity, freedom from serious illnesses, such as gout, rheumatism, and kidney disease, and a

comfortable existence. The excretory functions are considerably less active in advanced age, and the diet must be modified accordingly. As a general principle, it may be stated that the total amount of food should be restricted, and the food taken should be simple and nutritious, and an excess of animal products avoided. Old people are peculiarly liable to flatulence, and therefore the carbohydrates (starches and sugars) must be taken in moderation. Food should be taken at short intervals and should admit of easy mastication. Following is a sample menu for a normal individual over 60 (Watson):

6 A.M. Cup of tea freshly made; nothing to be eaten with it.

Breakfast: 8.30 A.M. A small cup of tea or coffee; eggs or fish cooked in various well-known ways. Breadstuff should not be hot rolls or indigestible new bread.

Luncheon: 1 or 1.30 P.M. Fish and a farinaceous pudding; or, fish and biscuits and cheese. It is, in most cases, better to reserve the meat or fowl to the evening meal.

Dinner: 7 P.M. Should generally commence with a little soup—a vegetable purée or a good fish soup. Fowl or game, red meat only occasionally, and one vegetable. Pudding of a light farinaceous variety, or stewed fruit.

10 P.M. A cup of consommé, beef tea, or chicken tea, with a thin slice of toasted bread.

**Diet in Disease.** In disease the activity of digestion is generally lessened, and there is a total waste or loss from the body of certain tissue constituents which in health are replaced as rapidly as they are excreted. In chronic disease the preservation of nutrition is of great importance from the start, and the highly nutritious foods are of the most value, varied from time to time as strength and appetite demand. In acute disease, with prostration, withdrawal of nitrogenous food is generally necessary, together with a diminution of starches and sugars and an increase of fats. In acute processes, accompanied by inflammation, as well as in fevers, serious changes occur in the constitution of the solids and fluids of the body. Interstitial fat disappears; muscles become pale and relaxed, and their contractibility is partially lost; digestion becomes impaired and remains either feeble, abnormal, or suspended; food is imperfectly prepared for assimilation and enters the blood in improper condition: the blood suffers alteration; the urine is found to contain an increase of urates and often also uric acid; the excretion of phosphates is increased, and that of chlorides is diminished; while in the tissues imperfect metamorphosis occurs, pathological materials being stored in them, together with waste products awaiting elimination, and a granular disintegration, or parenchymatous degeneration, may follow. The importance of a properly modified diet is obvious. In such cases milk forms the best diet, to the exclusion of all other food, and about six ounces of milk should be given to the patient every two or three hours, unless vomiting be present. Broths and soups possess very small value as food, but may be given in addition to the proper amount of milk for the sake of variety and to avoid the occurrence of a disgust for milk. With the fall of temperature the simpler solids are administered by degrees, beginning with soft-cooked eggs, green vegetables, oysters, etc. Beef tea is of very slight



value, and in no case should reliance be placed upon it as nourishment. When patients cannot take milk, peptonized combinations of beef, milk, and gluten may be substituted for it.

In disease of the digestive organs skim milk is of the highest value. Buttermilk, or sour milk, prepared artificially with the lactic acid bacillus or *Bacillus bulgaricus*, is of immense value as a substitute for sweet milk in children's summer digestive disturbances and in intestinal fermentation in adults. If acute and confined to the stomach, such disease is best combated if easily digested aliments are administered, as milk and limewater, whey, barley water, etc. In chronic affections of the stomach, with feeble digestion owing to deficiency of the gastric juice, the following articles of food will be found desirable: boiled rice, tapioca, arrowroot, biscuits (crackers), and farinaceous vegetables. Where fermentation of starchy and fatty foods occurs, these must be omitted from the diet, and in their stead acid fruits and vegetables, such as apples, peaches, tomatoes, tamarinds, oranges, etc., should be eaten. In intestinal indigestion and summer diarrhœa starches and fats should be omitted from the dietary, and milk, eggs, animal broths, broiled beefsteak, oysters, and fresh fish are suitable. Habitual constipation due to torpor of the muscular layer of the intestine may be relieved by a diet of cereals, whole-wheat bread, fruits, and green vegetables, with liberal quantities of water.

In many diseases particular diets are requisite. In *diabetes*, e.g., all sugar and sugar-producing food must be withheld, while animal food and fats must be administered in abundance. Water must be drunk freely. Saccharin must be substituted for sugar. The patient may therefore take meat soups; fresh fish, lobsters, and crabs; fat meat, poultry, kidneys, sweetbreads, ham, tongue, sausage, and all kinds of game; pickles, sardines, olives, celery; gluten bread, gluten rolls, gluten mush, almond bread and cakes, bran cakes; all green vegetables, nuts, acid fruits, cream custards, cheese, jellies, ice cream (made with saccharin), tea and coffee, koumiss, skim milk, red wine, mineral waters. All flour must be

carefully avoided. In *Bright's disease* the patient must avoid overfeeding and must take easily assimilated food that leaves a small amount of nitrogenous waste material. He may take soup made of arrowroot, milk, and rice, tapioca, or vermicelli; fresh whitefish, raw oysters and clams; very little red meat; chicken, game, fresh pork, bacon and ham; eggs sparingly; wheat bread, hominy, oatmeal, gruels, toast; green vegetables, well cooked; mushrooms, rhubarb; simple decoctions of milk and rice or of bread; stewed fruit; laxative raw fruits, fruit jellies; milk, koumiss, barley water, buttermilk, and mineral waters; very weak tea. In *tuberculosis* the patient should eat as much as can be digested, mostly of fatty and nitrogenous foods, taking food between meals and at bedtime, and thus receiving some food every three hours during the day. He may take soups; fresh fish and oysters; all meats not smoked or salted, except pork; eggs in all forms except fried; breads with an abundance of butter; all green vegetables, no roots, no potatoes; fats and olive oil; fruits, cheese, farinaceous desserts; milk, cream, cocoa, koumiss, Vichy water, lemonade, mineral waters, and stimulants as ordered by the phy-

sician. It is imperative that food prepared for invalids should be well cooked. The taste and appetite are not trustworthy guides in sickness, but odors, flavors, and dainty serving should be considered. Food should be served very hot or very cold; seasoning, except with salt, should in general be avoided; and small quantities should be offered at a time, with scrupulous care that utensils and linen be clean.

**Diet in Convalescence.** In acute illness the digestive tract is weakened temporarily, and the patient undergoes a species of starvation. During convalescence caution has to be observed in feeding the young and vigorous, since the appetite returns before digestive vigor is re-established. In typhoid fever, especially, it is dangerous to advance too rapidly, since a mass of undigested food may cause a relapse by setting up irritation in partially healed intestinal ulcers. The fever diet should be gradually reinforced by thickened beef tea, soup, egg drinks, and various jellies; this is followed by the easily digested starches, together with lightly cooked eggs, custards, milk puddings, toast, etc.; then fish, sweetbreads, chicken, chops, and other meats are given in small quantities, and lastly vegetables and fruits will be added to the dietary. The period of convalescence from most fevers may be considered roughly as seven days.

Many forms of diet have been advanced by faddists in the way of cures. Among these may be mentioned the following:

*Vegetarianism* is a term loosely applied to restricted dietaries which have for their object the exclusion of flesh food. The strict vegetarian relies solely on vegetables grown in the soil and fruits. The *fruitarian* or *lacto-vegetarian* diet includes certain animal foods, such as milk, cheese, eggs, vegetables, fruits, cereals, pulses, sweets, tea, coffee, and cocoa. A variety of this latter vegetarian diet is one restricted to uncooked food. The advocates of this system, first introduced by Christian, hold that the vital principles of food are affected by cooking. The diet consists largely of fruits, nuts, pine kernels specially treated, milk, raw eggs, uncooked vegetables, a particular unfired bread of pressed grains, and some cereals. The distinctive feature of this diet is that it requires thorough mastication.

**Purin-Free Diet.**—Attention has been recently directed to the advantage of this diet in the treatment of certain chronic diseases, such as gout, neuralgia, headache, and Bright's disease. It is based on the theory that there is in these maladies a retention in the system of uric acid and other purin substances, resulting in chronic poisoning. Purins are bodies constructed on the base  $C_5N_4$ . The most important are uric acid, xanthin, phyoxanthin, adenin, and guanin. They are derived from animal food (meat, sweetbreads, liver), beans, lentils, and oatmeal. Tea and coffee also contain them. Examples of purin-free foods are milk, cheese, cream, butter, fats, white bread, eggs, apples, grapes, figs, dates, and raisins. Macaroni and nuts are also purin-free. It will be observed that, on the whole, these foods are less appetizing than those containing purin, and overindulgence in them is not likely.

**Salisbury Diet.**—This is a diet consisting



chiefly of meat and hot water and was advocated for tuberculosis in 1889, when Richet and Hericourt showed the value of raw-meat diet in tuberculosis in dogs. A similar diet was recommended by Dr. Salisbury for the treatment of chronic gout, obesity, gastrointestinal disorders and other disorders of nutrition, attributed by him to carbohydrate fermentation. In its strict form the treatment consists in the administration of one to three pounds of meat and from three to five pounds of hot water per day, for a period of from one to three months.

*The Grape Cure.*—Among the various forms of fruit diet the grape cure is probably the best known, being recommended for cases of abdominal plethora, chronic bronchitis, emphysema, chronic constipation, and gastrointestinal catarrh. It is extensively practiced in the grape-growing districts of Meran and Montreux and other parts of southern Europe. The cure consists in taking from one-half to one pound of grapes, three-quarters of an hour before meals, the latter consisting of light, easily digested food, such as fish, chicken, milk puddings, stewed fruits, green vegetables, etc., and avoiding rich sauces, pickles, lentils, pastry, cheese, and sweets.

For special diet suitable to very young children, see INFANTS, FEEDING OF; for diets in obesity, see under that title; see also the general article FOOD, and the special articles MEAT, FISH, BREAD, ETC.; MEAT EXTRACT. Consult: Chittenden, *The Nutrition of Man* (New York, 1907); Chalmers Watson, *Food and Feeding in Health and Disease* (ib., 1913); Hindhede, *Protein and Nutrition* (London, 1913).

**DIET** (etymology same as preceding). A name at present applied to the legislative bodies in the German states, to the provincial assemblies in Austria, and to the Hungarian Parliament. These assemblies are called in German *Landtage*. The German Imperial Parliament bears the name of *Reichstag*, which word, when applied to the representative assembly of the old German Empire (Holy Roman Empire), figures in English works as Diet. The federal assembly of the Germanic Confederation (*Bundesrat*) is also styled Diet in English. The word "Diet" is also applied to the representative assemblies in the old Kingdom of Poland and other countries. The Diet of the Holy Roman Empire was made up of the Electoral College (q.v.), the princes of the Empire, spiritual and temporal (including the counts and other nobles, who voted only by groups), and the delegates of the free Imperial cities. The princes, save in the matter of electing the Emperor, had the same rights as the Electoral College. The powers of the free Imperial cities were quite limited, and were not even formally recognized until 1648. Each of the three colleges voted separately. When they agreed on a measure, it was submitted to the Emperor for ratification or for rejection, but he had no power to modify it. No measure affecting the welfare of the Empire could be passed without the assent of the Diet. The regular meetings were held twice a year, usually in some chief town of the Empire. After the close of the Thirty Years' War the power of the body declined, though it continued to hold its meetings at Ratisbon down to the dissolution of the Holy Roman Empire in 1806. Consult: Bryce, *The Holy Roman Empire* (London, 1871); Waitz,

*Deutsche Verfassungsgeschichte* (6 vols., Berlin, 1865-96); Turner, *The Germanic Constitution* (New York, 1888).

**DIETERICI**, dē'tā-rē'tsē, FRIEDRICH (1821-1903). A German Orientalist, born in Berlin. He studied at the universities of Halle and Berlin, traveled extensively in the East, and in 1850 was appointed professor of Semitic literature in the University of Berlin. He won particular distinction by his researches in the Arabic language and literature. The long list of his published works includes: *Alfiyyah Carmen Grammaticum Auctore Ibn Mālik cum Commentario Ibn Akil* (1851); *Mutanabbih Carmina cum Commentario Wahidii* (1858); *Der Naturanschauung und Naturphilosophie der Araber* (1860; 2d ed., 1876); *Die Logik und Psychologie der Araber im zehnten Jahrhundert* (1867); *Die Lehre von der Weltseele bei dem Arabern* (1872); *Die Philosophie der Araber im neunten und zehnten Jahrhundert nach Christus* (1876); *Die Abhandlungen der Ichwān Es-Safā in Auswahl* (1883-86); *Alsarabis philosophische Abhandlungen* (1890); *Ueber des älteste Bekenntnis der Christenheit* (1895); *Muhammad ibn Muhammad 'abū nasr al-Farābī: Die Staatsleitung . . . aus dem Nachlasse . . . F. Dieterici*, ed. by Paul Brönnle (1904).

**DIETERICI**, KARL FRIEDRICH WILHELM (1790-1859). A German economist. He was an engineer geographer in Blücher's army from 1813 to 1815, was engaged in the Ministry of Public Instruction, became professor of political science in the University of Berlin, and in 1844 was placed at the head of the statistical bureau. He published a number of important works on political economy and statistics, among which may be mentioned: *De Via et Ratione Economiam Politicam Docendi* (1835); *Statistische Uebersicht der wichtigsten Gegenstände des Verkehrs und Verbrauchs im preussischen Staat und im deutschen Zollverband* (1838); *Ueber Auswanderungen und Einwanderungen* (1847).

**DIETRICH**, dē'trīk, AUGUSTE EDGARD (1846- ). A French author, born at Nancy. From an early age he took a special interest in the German language and literature, and was the first to translate two of Max Nordau's works into French under the following titles: *Les mensonges conventionnels de notre civilisation* (1886) and *Le mal du siècle* (1890). He contributed to many French and foreign reviews, such as *La Revue du Nord*, *La Jeune France*, and *Le Messager de Vienne*, and translated Lady Blennerhassett's *Madame de Stael et son temps* (1890). His original publications include: *Les maîtresses de Louis XV* (1881); *Rouget de Lisle et la Marseillaise* (1882); *Jacques Richard et la presse* (1886); *La mort de Danton* (1888). He also edited the *Poésies de Jacques Richard* (1885).

**DIETRICH**, dē'trīk (also **DIETERICI** and **DIETRICY**), CHRISTIAN WILHELM ERNST (1712-74). A German painter, etcher, and administrator, born at Weimar. He studied under his father, the court painter at Weimar, and under Thiele in Dresden. In 1741 he was appointed court painter at Dresden, in 1748 inspector of art galleries, and in 1764 director of the manufactory of porcelain at Meissen and professor of the Academy of Dresden. In his art Dietrich was a typical eclectic, who imitated every school with great facility, but he showed most understanding of the Dutch. He painted every subject, his religious pictures being the

best. His works are numerous in nearly all German galleries, especially in Dresden with 53 and Schwerin with 56, and in many palaces and churches in Germany.

**DIETRICH OF BERN.** The name under which Theodoric the Great (q.v.) appears in German heroic legends; by Bern, his capital, Verona is to be understood. With a not unusual disregard of all historical truth, Dietrich was brought into connection with the traditions of Attila, or Etzel. According to these legends, Dietrich is said to have fled from Italy before Ermanaric, or in later poems Otacher (Odoacer), and to have met with a hospitable reception from Etzel. After many years he regained possession of his kingdom. Dietrich appears in the second part of the *Nibelungenlied*, at Etzel's court, and is praised with special predilection. There were numerous other poems in which Dietrich was the central figure, but only late versions of these poems have come down to us. Consult Sandbach, *Heroic Saga-Cycle of Dietrich of Bern* (London, 1906), and Hodgkin, *Theodoric the Goth* (New York, 1891).

**DIETRICHSON, dē'trik-sōn, LORENTZ HENRIK SEGELCKE** (1834- ). A Norwegian art historian. Born at Bergen, he studied at Christiania, was an instructor in the University of Upsala, then spent three years in Rome as secretary of the legation, after which he became an official in the National Museum in Stockholm. In 1869 he became professor in the Academy of Arts at Stockholm and in 1875 professor of the history of art in the University of Christiania. Although taking as his special field the mediæval art of Norway, he wrote much and well on related subjects.

**DIETRICH VON NIEM, dē'trik fōn nēm.** See NIEM, DIETRICH VON.

**DIETSCH, dēch, HEINRICH RUDOLF** (1814-75). A German classical scholar, born at Mylau. In 1847-62 he was one of the editors of the *Neue Jahrbücher für Philologie und Pädagogik*. He published a valuable edition of the complete works of Sallust (2 vols., 1843-46; 4th ed., 1874) and a *Versuch über Thucydides* (1865).

**DIETZ, dēts, FEODOR** (1813-70). A German historical and battle painter. He was born at Neunstetten, Baden, and first studied under Karl and Rudolf Kuntz in Karlsruhe, where he was strongly influenced by Feodor Ivanowitch. He then studied at the Munich Academy, chiefly under Philip Foltz, whom he aided in the decoration of the new royal palace. His first independent effort, "Death of Max Piccolomini" (1835), now in the Karlsruhe Gallery, attracted great attention. He spent three years in Paris, where he was influenced by Horace Vernet, and was awarded the gold medal in the Salon of 1839. He was appointed court painter at Karlsruhe, but returned to Munich, where he produced his best work. He took part as a volunteer in the campaigns of 1848-49 in Schleswig-Holstein, and in 1862 was made professor of the newly created School of Arts at Karlsruhe. He died while serving in the Franco-Prussian War of 1870. His work was often theatrical, but is clear in composition and spirited in treatment. Among his best canvases are: "Nocturnal Review" (1853), acquired by Napoleon III; "The Destruction of Heidelberg by General Mela" (1856), in the Gallery at Karlsruhe; "Flight of an American Family across the Susquehanna," an interesting romantic genre piece (Paris Ex-

position, 1867); "Blücher's March to Paris" (1868), in the National Gallery in Berlin.

**DIEU ET MON DROIT, dyē ā mōn drwā** (Fr., God and my right). The battle cry of Richard I at the battle of Gisors (1198), signifying that he was not subject to France, but owed his power to God alone. The King was victorious over the French, and the battle word was adopted as the motto on the coat of arms of England. Edward III revived the motto in 1340.

**DIEULAFOY, dyē'lā'fwā', GEORGES** (1840-1911). A French physician. He was born in Toulouse and studied in Paris. In 1886 he was appointed professor of at the University in that city and in 1890 he became clinical professor at the Hôtel Dieu. In the publication entitled *De l'aspiration pneumatique souscutanée* (1870) he recommended the method of puncturing the thorax discovered by Van den Corput in 1857, for the treatment of pleurisy. Another important work is the *Manuel de pathologie interne* (2 vols., 1882; 16th ed., 1911; Eng. trans. by V. E. Collins and J. A. Liebmann, 1911). His investigations on appendicitis attracted wide attention in medical circles.

**DIEULAFOY, MARCEL AUGUSTE** (1844- ). A French engineer and archaeologist, born in Toulouse. While in Persia in 1885, he discovered at Susa the remains of the palaces of Darius I and Artaxerxes. He brought back to France a quantity of very valuable specimens of Persian architecture, which have a special department in the Louvre, and published an account of his discoveries in the book *L'Art antique de la Perse* (1884-89, 5 vols.); and he published also *L'acropole de Suse d'après les fouilles exécutées en 1884-86* (Paris, 1890-92), and *Art in Spain and Portugal* (1914).—His wife, JEANNE-RACHEL MAGRE (1851- ), accompanied her husband in these journeys and assisted him materially. Her works include: *La Perse, la Chaldée, et la Susiane* (1887); *A Suse* (1888); and several novels and plays. She was made a member of the Legion of Honor. In collaboration with her husband, she published *Le théâtre dans l'intimité: Nais la Sulamite, farce nouvelle du paté et de la tarte* (2 vols., 1900).

**DIEZ, dēts, FRIEDRICH CHRISTIAN** (1794-1876). A German philologist and founder of the scientific study of Romance philology. He was born and educated at Giessen, served in the War of Liberation, and later took a supplementary course in philology at Göttingen. In 1830 he was called to the chair of Romance philology at Bonn. The works respectively entitled *Die Poesie der Troubadours* (1826; 2d ed., 1883) and *Leben und Werke der Troubadours* (1829; 2d ed., 1882, by K. Bartsch) soon made him widely known. These and the standard publication entitled *Grammatik der romanischen Sprachen* (1836-42; 5th ed., 1882; Eng. trans. by Cayley, 1863; Fr. trans. by Brachet, Gaston Paris, and Morel-Fatio, 3 vols., Paris, 1874-76) and *Etymologisches Wörterbuch der romanischen Sprachen* (1853; 5th ed. by Von Scheler, 1887; Eng. trans. by Donkyn) obtained recognition even among the Romance nations as works of basic importance. They are written in a clear and concise style, and in them the author has given to the world a classic example of the historical and comparative method of investigation. Consult: Breyman, *Friedrich Diez, sein Leben, seine Werke* (Munich, 1878);

Behrens, *F. Diez* (Giessen, 1894), published in honor of the hundredth anniversary of his birth; Ritter, *Le centenaire de Diez* (Geneva, 1894), which contains unpublished letters of Diez and his friends.

**DIFFERENCE** (OF., Fr. *différence*, Lat. *differentia*, from *differre*, to differ, from *dis-*, apart + *ferre*, to bear). In heraldry, an addition to or alteration in an escutcheon to mark a distinction between the coats of arms of two closely related persons whose shields would otherwise be the same. Though generally confounded with marks of cadency (q.v.), differences have, in strict usage, a totally different function—the former being employed to distinguish brothers and their descendants after the death of the father, the latter while he is still alive. Differences in this limited sense may consist either of a chief added to, or a bordure placed round, the plain shield borne by the head of the house; or should the shield exhibit any of the ordinaries, as the bend, fess, or pale, the difference may be indicated by an alteration in the lines of the ordinary. The proximity of the bearer to the head of the house is indicated by the character of the line by which the differentiating chief, or bordure, or ordinary, is marked off from the field, the following being the order usually observed: the first or eldest brother, on the death of his father, inherits the pure arms of the house; the second brother, if the difference is to consist of a bordure, carries it plain; the third, ingrailed; the fourth, invected; the fifth, embattled; etc. Other modes of differencing have been invented by heralds, and are not unknown to practice—such, e.g., as changing the tinctures either of the field or of the principal figures, of which Nisbet gives many famous examples; altering the position or number of the figures on the shield; adding different figures from the mother's coat or from lands, and the like. Where the cadet is far removed from the principal family, if the field be of one tincture, it is sometimes divided into two, the charge or charges being counterchanged, so that metal may not lie on metal, nor color on color. The confusion between differences and marks of cadency, above referred to, occurs in the heraldic usage of England, Scotland, and the countries of the Continent. In France the cadets of the house of Bourbon have been in the habit of continuing these marks, and at the present day the label or lambel is to be seen on the arms of all the members of the Orléans family. That no distinction between what we call marks of cadency and differences was there observed is further apparent from the fact that, while such was the practice of the house of Orleans, the house of Anjou carried a bordure gules, and that of Alençon a bordure gules charged with eight bezants. In Germany, according to Sir George MacKenzie, several branches of great families are distinguished only by different crests, because, he says, all the sons succeed equally to the honors of the family. In Great Britain and in France some change is always made on the shield as carried by the head of the house; but the practice even of good heralds has been so lax as to bring the rule very nearly to what Voltaire holds to be the correct one—that every private person should be allowed, with the sanction of the proper authorities, "to make what marks of distinction can suit best with the coat which his chief bears." See **HERALDRY**.

**DIFFERENCE.** In mathematics, difference usually means the excess of one quantity over another of the same kind, and this is its meaning in arithmetic. In higher mathematics, however, it is used in a special sense in connection with series and functions. Consider the following systems:

Given series	4, 7, 11, 18, 31, 54, 92, 151, 238, . . .
First differences	3, 4, 7, 13, 23, 38, 59, 87, . . .
Second "	1, 3, 6, 10, 15, 21, 28, . . .
Third "	2, 3, 4, 5, 6, 7, . . .
Fourth "	1, 1, 1, 1, 1, . . .

The law of formation is not obvious in the first series, but by . . . successive terms and forming the . . . repeating the process and forming the second differences, and repeating it again for the third differences, a series is found whose law of formation is obvious. Beginning with 7, the sixth term of the third differences, the ninth term of the given series is evidently 238. The general formula for the *n*th term of such a series is

$$t_n = a + (n-1)b + \frac{(n-1)(n-2)}{1 \cdot 2} \cdot c + \frac{(n-1)(n-2)(n-3)}{1 \cdot 2 \cdot 3} \cdot d + \dots$$

in which *a*, *b*, *c* . . . represent respectively the first term of the several series. The sum of *n* terms is expressed thus:

$$S_n = na + \frac{n(n-1)}{1 \cdot 2} \cdot b + \frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3} \cdot c + \dots$$

Certain calculating machines (q.v.), particularly the difference engine, are constructed on this principle. Out of the method of differences arose the calculus for finite differences. (See **CALCULUS**.) Pierre Raymond de Montmort (1678-1719), François Nicole (1683-1758), and Brook Taylor (1685-1731) were pioneers in this subject.

**DIFFERENCE, METHOD OF.** See **INDUCTION**.

**DIFFERENCE, SPECIFIC, or DIFFERENTIAL.** See **PREDICABLE**.

**DIFFERENCE OF LATITUDE.** See **LATITUDE AND LONGITUDE**.

**DIFFERENCE OF LONGITUDE.** See **LATITUDE AND LONGITUDE**.

**DIFFERENTIAL (in Motor Vehicle).** See **MOTOR VEHICLE**.

**DIFFERENTIAL CALCULUS.** See **CALCULUS**.

**DIFFERENTIAL EQUATION.** See **EQUATION**.

**DIFFERENTIALIA'TION.** See **CALCULUS**.

**DIFFERENTIATION.** In biology, the process by which the body becomes more complex by becoming different in its different parts. Both phylogenetically and ontogenetically organisms begin in a relatively simple state; evolution and individual development are both accompanied by specialization of organs and division of labor among the various parts of the body.

**DIFFERENTIATION OF ROCKS.** A term used by geologists to denote the process by which varied types of igneous rocks develop from a uniform parent mass or magma. Volcanoes at different periods of their activity may erupt lavas of contrasting character, as has hap-

pened frequently in some of the craters in the Mediterranean region; also, bosses of granite, syenite, and other deep-seated rocks often show a considerable range of mineral composition between their interiors and the border zones. These and similar features which have been abundantly attested indicate that a reservoir of fused rock in the earth's interior is subject to successive cleavage or division, by which in place of a homogeneous mass several more or less distinct rock types result. The process of differentiation plays a very important rôle in the derivation of igneous rocks, and it seems probable that the many varieties into which they are divided have really sprung from a few fundamental magmas. The principle underlying the process is not well understood, although much study has been given to the subject in recent years. It is thought by some geologists that the force of gravitation during the crystallization of the magma effects a separation of the lighter and heavier minerals, resulting in the acidic and basic types that are frequently observed in a differentiated rock mass. Other causes of variation have been proposed, such as fractional crystallization, the influence of convection currents, the absorption of foreign material into the magma, and the action of mineralizing agencies, inclusive of gases and heated waters. See IGNEOUS ROCKS.

**DIFFRACTION AND DIFFRACTION GRATINGS** (from Lat. *diffringere*, to break in pieces, from *dis-*, apart + *frangere*, to break). When shadows are cast on a screen by allowing light from a small opening or source to pass an opaque body, it is noted that the shadows are not sharp, as would be expected if "light traveled in straight lines." Thus, if light from the sun or from any source of light falls upon a large opaque screen in which there is a narrow slit; and if there is placed some distance from this another opaque body with a sharp edge (e.g., a knife blade) parallel to the slit, the shadow of the latter cast by the light from the slit will have several peculiarities. Calling the geometrical shadow the region where there would be darkness if light traveled in straight lines, it will be observed that the actual shadow begins a slight distance within the "geometrical" one—in other words, the light is bent into the latter; further, on the edge of the geometrical shadow, where one might expect uniform illumination, there are series of narrow colored bands, parallel to the edge, i.e., there is first a strip brightly illuminated with one color, then another band with a different color, etc., the colors merging into each other; at a distance of a few millimeters from the edge of the shadow, however, the field is uniformly illuminated. If, instead of having white light as a source, a colored flame is used, e.g., light from a flame containing sodium, the bands outside the geometrical shadow become simply alternations of light of the colors of the flame, and comparative darkness. This phenomenon is called diffraction, and was first observed by Grimaldi, professor in the Jesuits' College, Bologna, in 1665. It was studied later by Newton, but was not explained until Fresnel made his classical research in 1819. Similarly, if light from a pin-hole opening falls upon any opaque object, casting a shadow of it on some suitable screen, diffraction bands may be observed outside the geometrical shadow, following the general contour of the latter; and the light enters slightly

into the shadow. For other cases of diffraction, reference should be made to some treatise on light. One of the best is Preston's *Theory of Light* (London, 1901).

It was shown by Fresnel that diffraction phenomena are explained by the fact that light is due to a wave motion (see LIGHT); consequently diffraction is possible with other waves, e.g., those in air which produce the sensation of sound.

The colors of the feathers of many birds and of mother-of-pearl are due to diffraction; so are the colors seen when one looks at a bright light through a piece of thin cloth. If a great number of fine scratches, evenly spaced, are made on a piece of glass, or on a polished mirror, there is formed a "diffracting grating." The former is called a transmission grating; the latter, a reflecting one. If, as in a previous experiment, white light from a slit in an opaque screen is allowed to fall perpendicularly upon a transmission grating, the slit being parallel to the scratches, the transmitted light will be broken up into spectra, regularly spaced on both sides of the line drawn from the slit to the grating, except in the direction of this line. Thus, if the transmitted light falls upon a white screen parallel to the grating, there will be a central white spot, and on each side of this, along a line at right angles to the lines on the grating, a succession of colored spectral bands. This spreading sidewise of the light is due to its diffraction through the narrow, transparent slits between the scratches; and the dispersion of the white light is occasioned by the fact that the amount of diffraction varies with waves of different wave number, i.e., with different colors (see LIGHT). The same phenomena are observed with reflection gratings if the screen is placed on the same side as the slit of light and provided with an opening to allow the light to fall upon the grating.

Gratings are of the utmost importance in spectroscopy (q.v.), as they furnish a means of measuring the wave lengths of ether waves. They were invented and first used by Joseph von Fraunhofer, of Munich, in 1821. To be of value, gratings must be ruled with the scratches at *exactly* equal intervals. This is secured by placing the surface to be ruled on a platform, which is carried forward by a long screw, whose thread is perfectly uniform, and by having a diamond point so arranged as to draw lines at right angles to the direction of the screw. By means of a toothed wheel fastened to the screw it is turned through a definite proportion of one complete revolution, thus carrying the platform forward a definite distance; e.g., if the threads of the screw are at a distance 1-15th of an inch apart, and if the toothed wheel has 1000 teeth, then, if this wheel is pushed round by an amount equal to one tooth, the screw will turn through 1-1000th of a complete revolution and will carry the platform forward 1-15,000th of an inch. Then the diamond is drawn across the surface of the grating, making a groove; it is raised, pushed back to the other side of the grating, dropped down, and again drawn across the surface, the platform in the interval of time, while the diamond is pushed back, having been carried forward another step. The process is continued until as many lines are made as are desired. Such a machine is called a "dividing" or a "ruling" engine. (See DIVIDING ENGINE.) The most perfect gratings now in use have been

made at the physical laboratory of Johns Hopkins University, where Professor Rowland supervised their preparation. His gratings have, as a rule, 15,000 lines or scratches to the inch; and the grating surfaces vary from 2 inches to 6 in width.

To use gratings ruled on plane surfaces for spectroscopic purposes, it is necessary to combine them with telescopes and collimators; but Professor Rowland has shown that reflecting gratings ruled on spherically concave surfaces can be used without the addition of lenses. These "concave gratings" have other marked advantages over plane ones for almost every spectroscopic purpose. A good description of their properties is given in Preston's *Theory of Light* (London, 1901).

**DIFFUSION** (Lat. *diffusio*, a spreading out, from *diffundere*, to diffuse, from *dis-*, apart + *fundere*, to pour). The gradual dispersion of the particles of one substance among those of another.

**Diffusion of Liquids.** If sulphuric acid be carefully poured through a tube into the bottom of a vessel filled with water colored by a few drops of litmus solution, and the liquids allowed to remain undisturbed, the acid will be seen gradually to diffuse upward into the water, its progress being indicated by the change of color of the litmus from blue to red. After a sufficiently long time the liquid will be found perfectly homogeneous; i.e., the two layers of acid and water will have completely intermixed, forming a dilute solution of sulphuric acid of uniform strength throughout. A similar process would take place in the case of water and alcohol, and, in general, in the case of any pair of liquids that are at all capable of being mixed together. In many cases, however, the rate of diffusion would be so small that it might take months and even many years before the solutions would become perfectly homogeneous. The reason of this is that the surface of separation of two liquids is, under ordinary circumstances, comparatively very small. To render the diffusion more rapid, the surface through which diffusion takes place would have to be increased; and this is usually attained by *stirring* the two liquids with the aid of some solid object, as a glass rod or a spoon. Diffusion itself, however, is a purely molecular process; i.e., it involves the motion not of masses of liquid, but of molecules.

**Diffusion of Gases.** If two flasks be filled, one with hydrogen, the other with chlorine, and connected by a long tube fitted into their necks by means of corks, then, in whatever position the apparatus be placed, it will be found that the gases mutually interpenetrate. The color of chlorine will in this case enable us to follow by the eye the course of the diffusion. When the mixture has attained its permanent state, each of the gases is found to be uniformly diffused through the whole containing space, precisely as it would have been had the other not been present. In fact, the presence of a second gas seems merely to affect the time which the first takes to distribute itself evenly throughout the vessel, but in no other way to influence the final result. Dalton long ago suggested the analogy of the passage of water among stones in the bed of a river.

The molecules of gases are capable of passing through solid partitions, which would prevent the motion of masses. The phenomena of dif-

fusion can therefore be readily investigated by measuring the amounts of various gases passing in a given interval of time through a thin layer of bladder or other membrane, or through a thin disk of plaster of Paris, graphite, or biscuit ware. The velocity of diffusion is thus found to be inversely proportional to the density of the gas experimented upon. That lighter gases diffuse more rapidly than heavier ones may be demonstrated as follows: A glass tube, say, 1 inch in diameter, and 2 or 3 feet long, is closed at one end with a diaphragm of plaster of Paris and filled with hydrogen. Its open end is immersed in water, care being taken not to wet the diaphragm. Two processes of diffusion will then take place simultaneously: the hydrogen will diffuse out of the tube into the atmosphere, while the constituent gases of the air will pass through the diaphragm inward. But, as hydrogen is much lighter than the gases of the air, the velocity with which it escapes is greater than that with which the others enter, this being shown by a rise of water in the tube, whose part occupied by gas will continue to decrease until all the hydrogen has diffused out. See also *EFFUSION*.

**Diffusion of Substances in Solution.** According to modern chemical theory, solid substances in solution exhibit the same phenomena as substances in the gaseous state. Within a given volume of solution a substance exercises, e.g., precisely the same pressure (osmotic pressure) that it would exercise if vaporized and confined within a vessel whose volume is equal to the volume of the solution. This explains the analogy existing between the phenomena of diffusion of gases and the phenomena of diffusion of substances in solution.

Diffusion in solution was discovered in 1815 by Parrot, and was later (from 1850 on) made the subject of a thorough investigation by Thomas Graham. Shortly afterward Fick succeeded in proving, both theoretically and experimentally, that the diffusion of dissolved substances follows a law (Fick's law) precisely analogous to Fourier's law of the diffusion of heat. Accordingly the amount of substance traversing a small distance within the solvent in unit of time is proportional to the area of the cross section through which the diffusion takes place, and to the difference in concentration at the two ends of small distance traversed. The rate of diffusion depends, of course, also upon the nature of the diffusing substances, upon the nature of the solvent, and upon the temperature. At higher temperatures the rate of diffusion is invariably greater than at lower ones.

Solvents resist diffusion more or less, according to their nature; but it is as yet not known how the solvent resistance might in any given case be predetermined from the composition and perhaps other physical properties of the solvent and the diffusing substance. What we do know, however, is how to express in ordinary force units the frictional resistance offered by the solvent, provided we know the concentration of the diffusing substance and have determined experimentally the rate of diffusion. For, according to the modern theory of solutions, it is the osmotic pressure of the diffusing substance that overcomes the resistance of the solvent and drives the substance from points of higher to points of lower concentration, and the magnitude of osmotic pressure is readily ascertained. How enormously great the frictional resistance

of the solvent generally is, may be judged from the following typical case: to move 342 grams (= 1 gram molecule) of cane sugar at the rate of 1 centimeter per second, when the solvent is water and the temperature is 18° centigrade, it would be necessary to employ a force equal to no less than the weight of 4,700,000,000 kilograms.

The influence of the solvent and of the diffusing substance itself is numerically expressed by the so-called diffusion coefficient, frequently denoted by the symbol  $D$ . Stefan has shown that in any given case the diffusion coefficient may be determined, in accordance with Fick's law (see above), by using the following simple formula:

$$D = \frac{0.7854A^2}{c^2q^2t}$$

in which  $A$  is the amount of substance that has passed into a layer of the pure solvent from a layer of solution in the time  $t$ , the concentration of the solution being  $c$  and the area of the circular surface of contact of the two layers being  $q$ . The formula shows that, in any given case experimented upon, the amount of substance diffusing out of the solution is proportional to the square root of the time. In case the diffusing substance is either an acid or a base the rate of diffusion may be conveniently studied by coloring the pure solvent (usually water) with an indicator, such as litmus, and observing the change of color produced by the diffusing substance as it penetrates farther and farther into the column of pure solvent. In such a case, as shown by Stefan, Fick's law requires that the farthest distance to which the diffusing substance has penetrated must be proportional to the square root of the time that it has taken to get there. Both these theoretical consequences from Fick's law have been tested experimentally by a number of investigators and have been found to hold true, and therefore Fick's law may be considered as proved. In some cases the pure solvent employed (viz., water) was gelatinized by means of agar-agar or similar substances (see COLLOIDS), and Fick's law was still found to hold good. Only, curiously enough, while the amount of substance entering the gelatinized solvent in a given time was found to be exactly the same as if the solvent had been left liquid, the farthest distance to which the substance has penetrated was found to be appreciably less. In one sense, therefore, it may be said that substances diffuse with the same speed in a solvent whether this has been gelatinized or not; in another sense this statement is not true.

The diffusion of electrolytes has been theoretically investigated by Nernst and experimentally by Arrhenius. Electrolytes—i.e., acids, bases, and salts—are dissociated in solution into electrically charged particles, or ions. Each ion has a certain mobility, of its own. Thus, in a solution of hydrochloric acid the free hydrogen ions have far greater mobility than the chlorine ions. It might therefore appear as if the hydrogen ions ought to diffuse out of such a solution at a rate of their own, leaving the sluggish chlorine ions behind. As a matter of fact, however, the separation of positive and negative ions by diffusion would set up an enormous electrostatic attraction between the different parts of the solution, and

this would at once bring the different ions together again. In other words, while the positive and negative ions are in many ways free and independent of each other, they cannot enter upon independent courses of diffusion: the more mobile ones will hasten the progress of the less mobile ones by pulling them along; their own progress will thereby be retarded, the more sluggish ions holding them back. Taking into account both the separate mobilities of the ions and their modification by mutual electrostatic attraction, Nernst has shown that the resultant diffusibility of the electrolyte as a whole is expressed by the following formula:

$$\frac{1}{D} = \frac{1}{2RT} \left( \frac{1}{U} + \frac{1}{V} \right)$$

where  $D$  is the diffusion coefficient of the electrolyte as a whole;  $U$  and  $V$  are respectively the mobilities of the positive and negative ions;  $T$  is the absolute temperature (i.e., the centigrade temperature + 273°), and  $R$  is the so-called gas constant. The gist of this formula of Nernst's may be expressed in words by saying that the resistance encountered by the diffusing electrolyte as a whole is proportional to the sum of the resistances encountered by the separate ions. Experiment has borne out this proposition very well.

When a substance in solution is dissociated, not electrolytically, but chemically (see DISSOCIATION), matters are quite different: the products of dissociation exert comparatively little influence upon one another, and each diffuses almost independently of the rest. In the case of ordinary alum, e.g., it is thus possible to effect at least a partial separation of the component sulphates, because these have different diffusibilities. Colloidal substances, like albumen, are altogether left behind by crystalloids, owing to great differences of diffusibility, and therefore diffusion may be employed to render colloids perfectly pure (i.e., free from the more mobile crystalloids). See COLLOIDS.

**Diffusion of Solids.** The diffusion of solid substances through one another is shown by a number of phenomena. Not to speak of the even distribution of iron gas through a mass of platinum or palladium, the surface of which has been exposed to the gas, solid carbon is known to be capable of passing through porcelain and to distribute itself evenly in a mass of iron. Further, solid barium sulphate and solid sodium carbonate have been shown to react with each other chemically—a process which could hardly take place unless the molecules of the two substances became intimately intermixed by diffusion. Finally, experiments have been carried out on the diffusion of gold into lead at ordinary temperatures. At 18° C. gold has been found to diffuse upward, and after a lapse of four years traces of gold could be found at a distance of 7 millimeters from the surface of contact.

**DIGALLIC ACID.** See TANNIN.

**DIGAMMA** (Lat., Gk. *διγάμμα*, from *δι*, double + *γάμμα*, gamma). The name given by grammarians not earlier than the first century A.D. to Vau, anciently the sixth letter of the Greek alphabet. The name is due to the form, double gamma, *F*. In the Ionic alphabet it was almost completely lost at a very early date, save as the numeral 6; the Chalcidian alphabet, however, retained it, and transmitted it.



through Cumæ, to the Latins, with whom it lost its original sound (approximately our *w*), and became *F*. Even where it had ceased to be written, as in the Homeric poems and in Hesiod, its influence can be detected; in inscriptions it appears frequently in many dialects. Often the cognate words in other languages than Greek show it; e.g., *vinum* = *Foivos*, wine. Consult Buck, *Introduction to the Study of the Greek Dialects*, pp. 43-48 (Boston, 1910). See GREEK LANGUAGE, *Alphabet and Pronunciation*.

**DIGBY.** A port of entry and popular summer resort, capital of Digby Co., Nova Scotia, on Digby Basin, an arm of the Bay of Fundy and 43 miles southeast of St. John, New Brunswick (Map: Nova Scotia, D 4). It has fishing and lumber industries, a long pier, good bathing, boating, and fishing facilities, and a special reputation for a variety of small herrings or pilchards, known as "Digby chickens," which are cured for export. The United States is represented by a consular agent. Pop., 1901, 1150<sup>1</sup>; 1911, 1247.

**DIGBY, GEORGE**, second EARL OF BRISTOL (1612-77). An English legislator. He was born in Madrid, studied at Magdalen College, Oxford, was a member of the Long Parliament, and was one of the foremost opponents of Strafford. He was extremely vacillating by nature, and, with Pym and Hampden, espoused the royal cause and was taken from the Commons and put in the House of Lords. Apparently he suggested to the King the arrest of the five members. In the Civil War he was lieutenant general of the royal army. During the Commonwealth he lived in France, where he became lieutenant general, but was dismissed for political intrigue against Mazarin. After his return to England he accused Lord Clarendon of high treason. In his last years he seemed to waver in his loyalty to the Roman Catholic church. He wrote the comedy *Elvira; or, The Worst Not Always True* (1667), an adaptation from Calderon.

**DIGBY, SIR KENELM** (1603-65). An English author and naval commander. He was born three years before the execution of his father, Sir Everard Digby, noted as one of the gunpowder plot conspirators. At the age of 15 he was entered at Gloucester Hall, Oxford. Leaving the university in 1620, without a degree, he traveled abroad. Returning, he was knighted. In 1625 he married the celebrated Venetia Stanley. In 1628 he equipped two ships at his own expense and sailed on a privateering expedition against the French and Venetians in the Mediterranean. He won a victory in the harbor of Iskanderun. In 1632, on the death of Dr. Allen, of Gloucester Hall, Digby inherited his collection of books and manuscripts, which he presented to the Bodleian Library. In the troubles between King Charles and Parliament Digby took the Royalist side, and was imprisoned in Winchester House, but in 1643 was allowed to retire to France. After Charles I had fallen, Digby returned but Parliament forbade him the penalty of death. Retiring to the Continent, he traveled in France and Italy; but in 1655 he was again in England and was in frequent attendance at the court of the Protector. He went again to France and busied himself with the preparation of philosophical papers. He returned to England in 1661 and died there. His works are numerous and on a great variety of subjects,

comprising: *A Conference with a Lady About Choice of Religion* (Paris, 1638); *Observations on Spenser's Faery Queene* (London, 1644); *A Treatise on the Soul, Proving its Immortality* (Paris, 1644); *Of the Cure of Wounds by the Powder of Sympathy* (London, 1658); *Discourse on Vegetation* (ib., 1661); etc. *The Private Memoirs of Sir K. Digby, etc., Written by Himself*, were published in London in 1827. Consult: "Journal of the Scanderoon Voyage," in *Camden Society Publications* (London, 1868); *Poems*, ed. Warner (London, 1877); T. Longueville, *Life of Sir Kenelm Digby* (New York and London, 1896).

**DIGBY, KENELM HENRY** (1800-80). An English writer. He was born at Clonfert, Ireland, graduated from Trinity College, Cambridge, in 1819, and soon afterward became a convert to the Roman Catholic church. He published many works, chiefly on mediæval theology, or reflecting the spirit of the Middle Ages. The list includes: *The Broad Stone of Honor* (1822); *Mores Catholici; or, Ages of Faith* (11 vols., 1831-40); *Comptum; or, The Meeting of the Ways* (7 vols., 1848-54); *Evenings on the Thames* (2 vols., 1860).

**DIG'-DIG'** or **DIK'-DIK'** (Arabic). See GAZELLE.

**DIGEST.** A topical arrangement or compilation of legal rules, judicial decisions, or statutes in condensed form; particularly the authoritative compilation of the civil law, otherwise known as the Pandects, made under the authority of Justinian (530-533). See CIVIL LAW; CODE; PANDECTS.

In English and American law the term is applied to a great number and variety of legal works of reference, ranging from such encyclopædic collections of special treatises as Bacon's and Viner's Abridgments and Comyns's Digest to the alphabetical arrangements of statutes and of case law which have monopolized the title in recent years. The former kind of digest was a favorite form of legal authorship in the earlier period of the common law, and several of these compilations—as those of Statham (about 1470), Fitzherbert (1516), Brooke (1568), and Rolle (1668)—long maintained a high position as legal authorities. The earliest of these are still useful as containing references to cases as yet buried in the Yearbooks and other early reports. As authorities, however, they have all been superseded in the estimation of lawyers by more systematic treatises.

The modern digest of case law is in effect an elaborate index to the enormous collections of judicial decisions in which the common law of Great Britain and of the United States lies embedded. The most authoritative of the English digests are those of Fisher and Chitty. Each American State has one or more of such compilations, of which Abbott's Cyclopædic Digest of New York decisions is perhaps the most extensive and complete. There are also digests of the Federal reports, of the United States statutes, and a comprehensive compilation of all the Federal and State reports, known as the Century Digest. The plan of all these digests of case law is substantially the same, consisting of an alphabetical arrangement of legal titles, under which are given brief statements of the rule or doctrine enunciated in each decision, together with the title and location of the case, in which the decision was rendered. (See ABRIDGMENT; REPORT.) Consult Wambaugh,

*The Study of Cases* (2d ed., Boston, 1894), and Lindley, "The History of Law Reports," in *Law Quarterly Review* (London, 1885).

**DIGESTER.** A name originally applied to a strong boiler, with a closely fitting cover, in which bones or other animal substances, placed in water, could be raised to a temperature above the boiling point, or 212° F. The word is now given a wider meaning; the material may be placed in some liquid other than water, and chemical action instead of heat may be used to effect the disintegrating process. The digester, in its simplest form, was invented in 1681 by Denis Papin (q.v.), a French scientist. It is made of iron or other metal, and has an air-tight cover, provided with a safety valve, from which steam may be allowed to escape when the pressure becomes too great. The increased pressure to which the contents of the boiler are exposed raises them to a much higher temperature than could be secured in an open vessel, reaching at times 400° F. At such a temperature bones will dissolve. In its modern form the Papin digester is put to much wider uses than the mere preparation of soup and extraction of gelatin from bones, for which it was originally intended. One application of the invention is the lard or grease tank, which is an essential feature of a large modern slaughterhouse. Into such tanks the carcasses of animals too poor for the regular market and the entrails and grease-yielding offal of other animals are thrown. Steam is applied, which resolves the contents of the tank into fat; water, which contains much soluble matter in solution; and mud, containing earthy and solid particles, the contents arranging themselves in layers, from top to bottom, in the order named, according to their specific gravity. The tank is usually a vertical cylinder, with a perforated false bottom, which holds the charge and at the same time allows the water of condensation to percolate into the lower chamber. There is a discharge hole at the bottom for removing the residuum, and a number of try cocks are arranged along the sides, by means of which the level of the fats and water may be ascertained. There may be two discharge cocks; through the higher one the floating fat may be decanted, and through the lower one the water may be drawn off, as the contents and state of the process require. In some forms of digesters, like those for treating garbage, the water and grease may be drawn off together and separated afterward. The solid matter, called *skat*, may be pressed or dried, or both, and is then utilized for various purposes.

A familiar example of a chemical digester is the apparatus for extracting tannin from nutgalls by means of ether. The nutgalls are placed in a vessel saturated with ether; the volatile extract falls into a closed vessel placed below and connected by means of a pipe with the top of the other vessel, to prevent the escape of the ether.

Digesters are used in the hydrolysis of starch to glucose through the agency of hydrochloric or sulphuric acid and in the soda process of making wood-pulp paper.

**DIGESTION, COMPARATIVE PHYSIOLOGY OF.** See ALIMENTARY SYSTEM, EVOLUTION OF.

**DIGESTION** (Lat. *digestio*, from *digerere*, to digest), IN PLANTS. The process by which foods are rendered fit for absorption, conduction, or assimilation (qq.v.). Foods are sometimes in-

soluble in water, or, when soluble, need to be altered to make them more readily diffusible or usable. It was formerly believed that, besides carbohydrates of the insoluble type, fats and proteins must be hydrolyzed before translocation is possible. We now know that fats move as such in the form of fine emulsions in case a little free fatty acid and the resulting soap is present. It is possible that peptones and proteins often move as such, the latter in the form of colloidal solutions. Yet that there is a general hydrolysis of fats and proteins in the storage organs of plants is evidenced by the rather general distribution of the necessary enzymes—lipases, proteases, and ereptases.

In general, plants do not possess special digestive organs, but digestion occurs in the cells which contain both storage material and the enzyme. This may be termed endocellular digestion, and stands in contrast to digestion in animals, where the enzyme is generally secreted into a special digestive cavity and extracellular digestion occurs. In insectivorous forms amongst plants true extracellular digestion occurs, and in grass seeds the various enzymes are secreted into the cells of the endosperm by cells of the scutellum and aleuron layer. See SECRETION.

Each prominent food is acted upon by a particular enzyme adapted to transform it. The following table shows the principal sorts of plant foods, the enzymes by which they are digested, and the most important products formed.

#### I. CARBOHYDRATES

Food	Enzyme	Product
Starch. . . .	diastase. . .	maltose
Inulin. . . .	inulase . . .	levulose
Celluloses . . . .	cytase. . .	a variety of sugar
Saccharose . . . .	invertase . . .	fructose
		{ glucose
Maltose . . . .	{ maltase }	{ glucose
	{ glucase }	{ arabinose
Pectins. . . .	{ pectase }	pectic acid
	{ pectinase }	

#### II. PROTEINS

Albumins, globulins, etc.	{ proteases. . . . }	{ proteoses
		{ peptones

#### III. OTHER FOODS

Glycerides (fats) . . . .	lipase. . . .	{ glycerin
		{ fatty acid
Glucosides. . . .	myrosin and emulsin	glucose and various substances

Some of the more prominent examples of digestion may be mentioned. When a fungus lives upon or in a dead or living body, it secretes enzymes which digest such of the substances it comes in contact with as it can attack; these may then be absorbed and used for its nourishment. During the day the leaves of green plants form carbohydrates faster than they can be carried away, and a portion is stored temporarily in the *chloroplasts* (q.v.) as starch granules. Later, and especially during the night, when no food is formed, these starch grains are digested and transferred to places of use or permanent storage. Towards spring potatoes lose their mealiness when cooked, and become gummy and sweetish on account of the digestion of starch into sugar by diastase. When the shoot starts to grow, the process is hastened. In the germination of spores and seeds the stored foods, starch, oils, and proteins, are generally digested by appropriate enzymes, and the materials thus made available for the growing parts.



**DIGESTION, ORGANS AND PROCESS OF, IN MAN.** The process of digestion is one of the chief of those organic functions directly concerned in maintaining the life of the individual, inasmuch as it is that through which the animal is enabled to receive aliment and to prepare it for accumulation. The function of digestion includes several minor or subordinate processes. According to Milne-Edwards, the acts of the digestive function may be classed as follows: (1) the prehension of the food, (2) its mastication; (3) its insalivation; (4) its deglutition; (5) its chymification or gastric digestion; (6) its chylification or intestinal digestion; (7) defecation; and (8) the absorption of the chyle. Before examining these acts in detail and the mechanism by which each is effected, it is necessary to have clear conceptions regarding the classification of food, the quantity of food, and other allied subjects, which are discussed in the article *Food*; and it is needful to know the causes of those sensations which we call hunger and thirst, which are, or ought to be, our natural guides regarding the periods for taking food and the quantity to be taken. The immediate cause of hunger cannot be explained; but that it is due to some peculiar condition of the gastric mucous membrane seems probable from the fact that the sensation continues after division of the pneumogastric nerves, from which the stomach mainly derives its nervous fibres, if we correctly interpret the feelings of the animals on which the experiments were made. In extreme hunger the sufferer complains of a sense of sinking, which is referred to the region of the stomach, while general faintness and sometimes considerable pain are present. Hunger, or the want of food which occasions it, may be diminished by rest, sleep, or any cause that retards the general change which is perpetually going on in all the tissues of the body. Tobacco and alcohol tend to limit the disintegration of the tissues and thus to keep off or diminish hunger. When the sensations of extreme hunger are not relieved by food, the body begins to feed upon its own tissues, and the symptoms of starvation (q.v.) begin to manifest themselves. The period at which death occurs from abstinence varies greatly in different animals—young animals always dying sooner than older ones. In man total deprivation usually causes death in about a week; but if a little drink be allowed, life is considerably prolonged.

We may now consider the different acts of which the digestive function is made up.

1. In the act of prehension man and the other vertebrates employ the hands or anterior extremities and mouth, the lips and anterior teeth, and, to a certain extent, the tongue. The prehension of fluids is effected in two ways: sometimes the liquid is poured into the mouth and is allowed to fall down the throat; in other cases, the tongue is used after the fashion of a piston, being drawn within the mouth so as to exhaust the anterior part of that cavity, and fluids are thus forced to enter by atmospheric pressure.

2. Mastication is effected in the mouth by means of the teeth (q.v.), or, in their absence in some animals, by hardened surfaces that perform their functions. The upper jaw is immovable; but the lower jaw, with its teeth, is capable of moving in all directions by means of powerful muscles. It is by the varied move-

ments of the lower teeth against the upper, through the action of these muscles, that the food is broken down or masticated. This operation is very important, since the more completely the food is broken down the more easily will it mix with the saliva and other digestive fluids.

3. Insalivation\* is effected by the admixture of the secretions of the three pairs of salivary glands (the parotids, the submaxillaries, and the sublinguals) and of the buccal mucus with the triturated food. (See *GLAND*.) The saliva is a colorless, turbid, viscid, inodorous, and tasteless fluid, which, after standing for some time, deposits a layer of pavement epithelium (see *EPITHELIUM*) and mucus corpuscles. In the normal state its reaction is alkaline, but the degree of alkalinity varies, and is greatest during and after meals. Saliva does not contain more than five or six parts of solid constituents to 995 or 994 parts of water, the most important ingredient being an organic matter termed *ptyalin*, and sulphocyanide of potassium, neither of which substances occurs in any other solid or fluid of the body. The daily quantity of saliva secreted by an adult man is estimated at about 48 ounces, but the activity of the salivary glands is dependent upon various influences and conditions. Thus, movement of the lower jaw, as in masticating, speaking, or singing, increases the secretion as also do acrid and aromatic substances, and dry, hard food; while the use of moist and soft food is accompanied by a scanty secretion. The uses of saliva in reference to digestion are partly mechanical and partly chemical. The moistening of the dry food by the saliva serves the double purpose of adapting it for deglutition and of separating the particles and thus allowing them to be more freely acted on by the other digestive fluids; moreover, from its viscosity, it lubricates the bolus of food and thus facilitates deglutition; and it is probably also subservient to the sense of taste. The great chemical use of the saliva is to convert the amylaceous (or starchy) portion of the food into glucose, or grape sugar, and thus promote its absorption.

4. Deglutition is the act by which the food is transferred from the mouth to the stomach. The pharynx, or cavity into which the mouth leads, takes so slight a part in the digestive process, that we need scarcely allude to any anatomical details connected with it. It is sufficient to observe that between it and the mouth is the pendulous or soft palate, which is a movable muscular partition that separates the two cavities during mastication. As soon, however, as the latter act is accomplished, and the bolus is pressed backward by the tongue, the soft palate is drawn upward and backward, so as to permit the passage of the food into the pharynx. The bolus, or pellet of food, having arrived near the œsophagus, or gullet (which is continuous inferiorly and posteriorly with the pharynx), is driven into it by the action of certain muscles, which almost surround the pharynx and are termed its *constrictor* muscles. All voluntary action ceases as soon as the food is pressed backward by the tongue into the pharynx. It is impossible to recall the pellet, and it is necessarily carried on into the stomach. On receiving the food forced into its upper extremity by the action of the constrictor muscles of the pharynx, the œsophagus is di-

lated (for it usually lies in a collapsed state, with its walls in contact, or nearly so); this contact of the pellet with its mucous membrane causes its muscular walls to contract, and the food is thus driven, by a series of these contractions, into the stomach, thus completing the act of deglutition.

5. Gastric digestion, or chymification, is the next process to be considered. The whole of the alimentary canal (Fig. 1) below the diaphragm (q.v.), or great muscular partition which separates the cavity of the chest from that of the abdomen, or belly, possesses the following characteristics in relation to structure: the stomach, the small intestine, and the large intestine are all lined by mucous membrane, have a muscular coat, consisting of two sets of distinct fibres—viz., circular fibres which surround the tube, or viscus, after the manner of a series of rings, and longitudinal fibres running in the same direction as the intestine itself—and are invested with a serous membrane, the peritoneum (see **SEROUS MEMBRANE**), which at the same time retains the viscera in their proper position and permits their necessary movements.

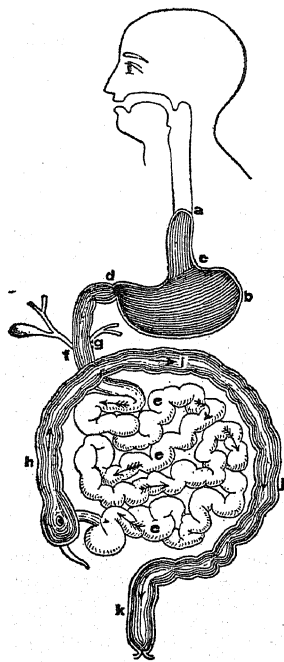


FIG. 1. HUMAN ALIMENTARY CANAL.

a, esophagus; b, stomach; c, cardiac orifice; d, pylorus; e, small intestine; f, biliary duct; g, pancreatic duct; h, ascending colon; i, transverse colon; j, descending colon; k, rectum.

traction of the muscular coat, except when the organ is distended with food. On opening the stomach we may perceive with a lens, even with the naked eye, numerous irregular pits or depressions, irregular in shape and averaging about 1-200th of an inch in diameter (Fig. 2, A). These pits dip into the mucous membrane about one-sixth or one-eighth of its thickness. The rest of the thickness is chiefly made up of minute tubes, running parallel to one another, and vertically to the sur-

face of the stomach (Fig. 2, B). These are the gastric glands which secrete the gastric juice from the blood in the capillaries which abound in the mucous membrane. They pass in twos,

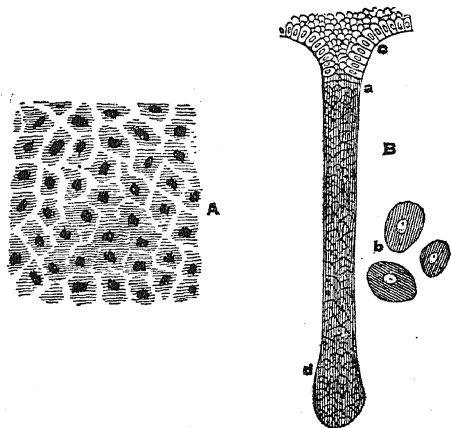


FIG. 2. A, inner surface of the stomach, showing the cells after the mucus has been washed out, magnified 25 diameters. B, stomach tube from the middle of the human stomach, magnified about 150 diameters; a, wall of the tube, lined with large oval, nucleated cells; b, the same cells isolated; c, nucleated cells of columnar epithelium, occupying the upper parts of the tubes; d, blind extremity of the tube.

threes, or fours from the bottom of each pit and usually subdivide into several tubes, which, after running a more or less tortuous course, terminate in blind or closed extremities. These tubes are filled with epithelial cells, whose contents are composed of granules, with which oil globules are often mixed, and each tube is invested with capillaries, which usually run in the direction of its long axis. In the pyloric or duodenal end of the stomach these tubes are considerably wider than those described and differ from them also in other respects; and hence some physiologists believe that while they collectively secrete the gastric juice, one set may secrete the acid fluid and the organic matter termed pepsin, and the other mucus; the free acid and the pepsin are, as we shall shortly see, the two essential constituents of the gastric juice.

When food is introduced into the stomach, three special phenomena are induced: (1) certain movements dependent on the muscular coat; (2) the mucous membrane is altered in appearance; and (3) gastric juice is secreted. Each of these phenomena requires a brief notice.

On killing an animal while the act of digestion is going on, and at once laying open its abdomen, we find that the stomach is in a contracted state, firmly embracing its contents, and with both its orifices so closed as to prevent the escape of the food, this contraction being due to the stimulation of the muscular coat by the food. If we examine the movements of the stomach during digestion, which we can do either by exposing the stomach of a living animal or by sending a magnetoelectric current through this organ in an animal just killed, we perceive that in the cardiac portion the movements are extremely slow, the muscular coat apparently contracting on the food and progressively sending it towards the pylorus; while in the pyloric end of the stomach the movements are more energetic and rapid, resembling the peristaltic movements, similar to

those occurring in the intestinal canal. When the transverse constriction has reached the firmly shut pylorus, a relaxation lasting about a minute ensues, followed by a repetition of the circular contractions. The movements which these contractions impress upon the food have been described in the following terms: "The food entering the cardiac end of the stomach, *c*, turns to the left, descends into the splenic extremity, and follows the great curvature towards the pyloric end, *d*. It then returns in the course of the smaller curvature, and makes its appearance again at the cardiac aperture in its descent into the great curvature to perform similar revolutions. These revolutions are effected in from one to three minutes." This account, given by Dr. Beaumont, is based on the observations which he made in the stomach of Alexis Saint-Martin, who had a fistulous opening into the stomach. (See BEAUMONT.) Dr. Brinton, however, adopts a modified view, which is probably the correct one. He supposes that the semifluid food entering at *c* (Fig. 3), the cardiac orifice, goes in the directions marked *a*, partly along the greater and partly along the lesser curvature; and that these two currents of food meet at the closed pylorus, when they are both reflected into the direction *b*, forming a central or axial current, occupying the real axis of the stomach, which unites the two apertures. The mutual interference of these

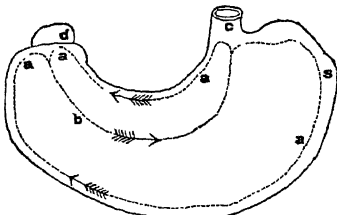


FIG. 3. Diagram to show the general direction of movement impressed on the semifluid food in the stomach.

*aa*, the hemispherical or surface current, carrying the semifluid food towards the closed pylorus, where it is deflected into *b*, the central current, which unites the cardiac (*c*) and pyloric (*d*) openings.

currents at their borders causes a uniform admixture of the various substances composing them, while the reflection of the upper and lower currents into one another insures an equal contact of all the mass with the secreting surface of the mucous membrane.

The mucous membrane are mainly the inner surface of the healthy is of a paler pink tint than after the introduction of food, and while in the latter case the reaction of the moisture on the surface is very acid, in the former it is neutral or even alkaline. Dr. Beaumont found (in the case of Alexis Saint-Martin) that, on the introduction of food into the stomach, the vessels of the mucous membrane became more injected, and that its color changed from a pale pink to a deep red. A pure, colorless, and slightly viscid fluid, with a acid reaction, was then observed to on the surface of the membrane and to collect in drops, which trickled down the walls and mixed with the food.

That the gastric juice is capable of exerting a solvent action on food is proved by numerous experiments. It was first ascertained by Réaumur (1752), who obtained some of this fluid by

making animals swallow sponges with a string attached, by which he could withdraw them. He thus showed that alimentary substances out of the body were altered by this fluid in the same manner as they are changed in the stomach, and disproved the favorite theory of that period, which ascribed all the changes which the food underwent in the stomach to a species of trituration. The subject of artificial digestion, or digestion out of the body, has been carefully investigated, and there is now no doubt that the changes which the food undergoes in the stomach are essentially chemical and not mechanical.

Two years before Beaumont's experiments, Dr. Prout had ascertained not only that an acid fluid is secreted by the gastric mucous membrane of rabbits, hares, horses, dogs, etc., during digestion, but that the acid is hydrochloric acid, and it was supposed that the solvent action of the gastric juice was due to this source. But experiments showed that the solvent action is not due simply to the acid of the gastric juice, and that the latter must contain some other ingredients which, either alone or in combination with the acid, can exercise this power. It was then discovered that the addition of a portion of the gastric mucous membrane to water acidified with hydrochloric acid produced a perfect digestive fluid, due attention being paid to the temperature, which should be about 100° F., or about the normal temperature of the interior of the animal body. Later observations showed that we can obtain from the gastric mucous membrane the special ferment on which its digestive power depends, and to this substance the name of *pepsin* has been given. The two essential elements of the gastric juice are, then: (1) a free acid, which in some cases seems to be hydrochloric alone and in others a mixture of hydrochloric and lactic acids; and (2) an organic matter, highly nitrogenous, and allied to the albuminates, called pepsin. The best analysis of human gastric juice is that made by Schmidt of Dorpat, who in 1853 had an opportunity of examining it in the case of an Esthonian peasant, Catharine Kütt, aged 35 years and weighing about 118 pounds, who had a gastric fistula under the left breast, between the cartilages of the ninth and tenth ribs. His analysis is still accepted as authoritative. The introduction of dry peas and a little water into the stomach through the opening (even in the morning, on an empty stomach) occasioned the secretion of from five to seven ounces of a clear limpid fluid with an acid reaction, which, however, was much less strong than Schmidt had observed in previous experiments on the of dogs and sheep, in which he similar fistulae. The gives the mean of two analyses of juice of Catharine Kütt, with corresponding mean results of the same fluid in the sheep, a purely herbivorous animal, and in the dog, a purely carnivorous animal:

	Human gastric juice	Sheep's gastric juice	Dog's gastric juice
Water . . . . .	994.40	986.15	971.17
Solid constituents . . . . .	5.60	13.85	28.83
Pepsin . . . . .	3.20	4.20	17.51
. . . . .	0.20	1.56	2.70
. . . . .	2.08	6.00	5.88
Phosphates . . . . .	0.12	2.09	2.74

The only impurity that could affect these analyses is the saliva that possibly might have been swallowed.

The quantity of the gastric juice secreted in 24 hours was determined by Bidder and Schmidt (*Die Verdauungssäfte, etc.*) in the sheep to be one-eighth, and in the dog one-tenth of the weight of the body. If the latter ratio were true for men, a man of 140 pounds' weight would secrete about 14 pounds of this fluid daily. In the case of Catharine Kütt, the mean daily quantity amounted to no less than 31 pounds, or to more than a fourth part of the weight of her body. On this calculation, a man of 140 pounds weight would daily secrete 37 pounds of gastric juice. Modern physiologists estimate the quantity at from 10 to 20 pints (or pounds).

The uses of this fluid are not only to dissolve, but also to modify, the nitrogenous elements of the food (such as albumen, fibrin, casein, and, in short, all animal food except fat, and the blood-forming portion of vegetable food), converting them into new substances, termed *peptones*, which, although they coincide in their chemical composition and in many of their physical properties with the substances from which they are derived, differ essentially from them in their more ready solubility in water and in various chemical relations. Thus, albumen is converted by the gastric juice into albumen-peptone, fibrin into fibrin-peptone, etc. According to the investigations of Meissner, the albuminates are simultaneously decomposed or broken up into peptones and substances which he terms *parapeptones*, which latter are not further changed by the action of the gastric juice, but are converted into peptones by the action of the pancreatic juice, with which they come in contact in the duodenum.

All observers agree that the gastric juice exerts no apparent action on the non-nitrogenous articles of food, viz., the fats and the carbohydrates (sugar, starch, etc.); as, however, the fats exert a favorable influence on the digestion of nitrogenous matters, it is probable that they undergo some slight, although not appreciable, modification. Gelatin and the gelatinous tissues are, as far as is known, the only nitrogenous articles of food which are not

not dissolve the quantity necessary for the due nutrition of the organism. According to Lehmann, gastric juice can only dissolve one-twentieth of its weight of coagulated albumen, while Schmidt makes the quantity as low as one-forty-fifth. Hence, its gastric juice only suffices for the digestion of half the albuminates necessary for nutrition—a result which is in accordance with the observed fact that a considerable portion of the albuminates enters the duodenum in an undissolved state, and which will be explained when we consider the part which the intestinal juice takes in the digestive process.

The process of gastric digestion is slow. According to Beaumont's researches on Alexis Saint-Martin, the mean time required for the digestion of ordinary animal food, such as butcher's meat, fowl, and game, was from two hours and three-quarters to four hours.

Frerichs and Donders maintain that the absorption of the peptones commences in the stomach; but the view generally adopted is that the albuminates, etc., which are converted into peptones, are for the most part taken up by the lacteals. The rapidity with which aqueous solutions of iodide of potassium, the alkaline carbonates, lactates, citrates, etc., pass into the blood, and thence into the urine, saliva, and other body fluids, shows that the absorption of fluids must take place very shortly after they are swallowed, and there is little doubt that the blood vessels (capillaries) of the stomach constitute the principal channel through which they pass out of the intestinal tract into the blood. As the veins of the stomach, which are formed by the union of these capillaries, contribute to form the portal vein (see CIRCULATION), the absorbed matters pass directly to the liver and probably stimulate it to increased secretion (Fig. 4).

6. We now follow the progress of the semi-fluid mass, known as the *chyme*, from the stomach into the small intestine, and notice the changes which are collectively impressed upon it, known as *chylification*, or intestinal digestion. But a few words are necessary regarding the intestinal mucous membrane, with its various glands, and on the changes which take place in it during digestion.

The mucous membrane of the small intestine resembles that of the stomach in so far as it is of considerable thickness, and consists in a great measure of laterally grouped tubes. Fig. 5 exhibits a section of the mucous membrane of the small intestine in the dog. The tubes, which form the great mass of the middle portion of the section marked *b*, are commonly called the *follicles of Lieberkühn*, although they were first

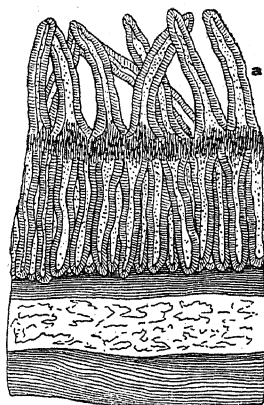


FIG. 5. Vertical and longitudinal section of the small intestine in the lower part of the jejunum, showing the general arrangement of its coats.

*a*, villi; *b*, intestinal tubes or follicles of Lieberkühn; *c*, submucous areolar tissue; *d*, circular muscular fibres; *e*, longitudinal muscular fibres.

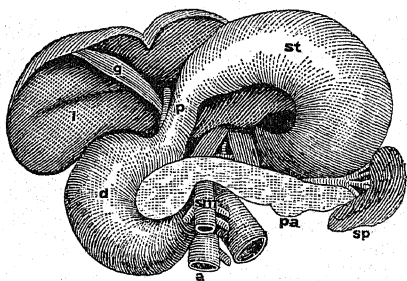


FIG. 4. The under surface of the stomach and liver, which are raised to show the duodenum and pancreas.

*st*, stomach; *p*, its pyloric end; *l*, liver; *g*, gall-bladder; *d*, duodenum, extending from the pyloric end of the stomach to the front, where the superior mesenteric artery (*sm*) crosses the intestines; *pa*, pancreas; *sp*, spleen; *a*, abdominal aorta.

converted into peptones and parapeptones by the action of the gastric juice.

Although the main object of the gastric juice is to dissolve the albuminates, etc. (e.g., the contents of the egg, flesh, cheese, etc.), it can-

described by Brunner. They are straight, nearly uniform in diameter throughout their entire length, and are parallel to one another, and perpendicular to the inner surface of the small intestine on which they open. The exact nature of their secretion is unknown; but in association with the secretions of other glands, they combine to yield the intestinal juice whose characters and uses will shortly be described.

The projecting bodies marked *a* in the figure are termed the *villi*; they are minute processes of the mucous membrane of the small intestine and obviously serve to increase to a great extent the amount of absorbing mucous membrane. They first appear in the duodenum, where they seem to develop themselves as elongations of the partitions between the cells or pits into which the tubes open. Comparatively scanty in number at first, they become very numerous (covering the whole surface) in the further part of the duodenum and the rest of the small intestines, giving to the mucous membrane a velvet-like or pilous appearance; they finally cease at the ileocaecal valve, which forms the boundary between the small and large intestine. In man they are conical in shape, and measure from  $\frac{1}{16}$  to  $\frac{1}{8}$  of an inch in length. They vary much in shape and size in the lower mammals and in birds. (In carnivorous animals, as the dog, they are longer and more filiform than in man.)

The structure of a villus (Fig. 6) is some-

A single artery enters its base and, passing up its centre, divides into a capillary plexus, which almost surrounds the villus immediately beneath the mucous membrane. From these arise small veins, which usually pass out of the villus in two, three, or more trunks, and contribute to form the portal vein. See CIRCULATION.

The villus also contains in its interior one or more *lacteals*, which are vessels with club-shaped closed extremities, which absorb the chyle from the intestine. Their milk-white appearance, when they are filled with chyle, suggests the origin of their name. The tissue which occupies the cavity of the villus, in which the lacteals are embedded, and which supports the capillary plexus, is in a great measure made up of nuclei and granules, except at the free extremity, where a vesicular structure, resembling very minute fat globules, is apparent.

The function of the villi is connected with absorption and mainly with the absorption of chyle. They exist only in the small intestine, where the absorption of food chiefly goes on; they are most developed in that part of the intestine where chyle is first formed; they are turgid, enlarged, and opaque during the process of chylification, and small and shrunken in animals that have been kept fasting for some time before death.

In addition to the villi the mucous membrane of the small intestine presents numerous transverse folds, which are termed the *valvulae conniventes*, from their valvular form and from their movements under water resembling the winking motion of the eyelids (Fig. 8). Each fold passes round three-fourths or more of the gut; and in the lower part of the duodenum and in the jejunum (the parts in which they are most fully developed), they are often more than half an inch in depth; farther on they diminish in depth, length, and number, and in the lowest part of the ileum they can scarcely be traced. Their object clearly is to increase the extent of the absorbent mucous membrane.

In addition to Lieberkühn's follicles or tubes, which exist in the whole of the smaller intestine, there are other glandular or secreting structures, embedded in the submucous tissue of certain portions of the intestinal tract. These are: (1) Brunner's glands (q.v.), which occur only in the duodenum; (2) solitary glands, which seem to occur in all parts of the intestines, both small and large; and (3) Peyer's glands, which are usually confined to the ileum.

Brunner's glands are most abundant at the pyloric end of the duodenum. In structure they resemble the pancreas, their ultimate elements being bunches of vesicles, from which minute ducts arise, which coalesce and form larger ducts, through which the secretion is poured into the duodenum. It is believed that they secrete a fluid similar to the pancreatic juice. The *solitary glands* occur in all parts of the intestine, but are perhaps more numerous in the jejunum than elsewhere. Each gland is a simple membranous flask-shaped vesicle, the neck corresponding to the surface of the intestine, while

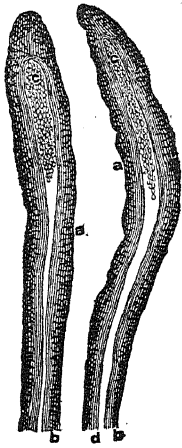


FIG. 6. Two villi, denuded of epithelium, with the lacteal vessels in their interior.

*a*, limitary membrane of the villus; *b*, basis of the same; *c*, dilated blind extremity of the lacteal; *d*, trunk of the same.

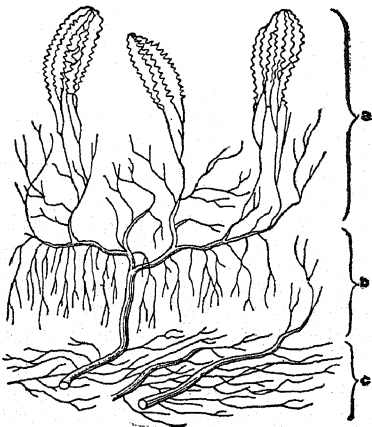


FIG. 7. Vertical section of the coats of the small intestine, showing the capillaries and the beginnings of the portal vein. The arteries are not seen, not having been penetrated by the injection which has been thrown into the portal vein. *a*, vessels of the villi; *b*, those of the tubes or follicles of Lieberkühn; *c*, those of the muscular coat.

what complicated. Each villus is provided with an abundant set of capillaries, which doubtless absorb fluid matters, which thus find their way directly from the bowels into the blood (Fig. 7).

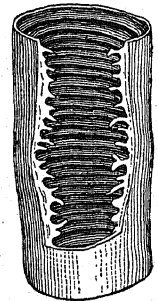


FIG. 8. Small intestine distended and hardened by alcohol, and laid open to show the *valvulae conniventes*.

the rounded base lies in the submucous tissue. The neck presents no opening, and how the contents, which consist of nuclei and granular particles, are discharged into the intestine is not clearly known. As we never see them larger than a mustard seed, we may presume that on attaining that size they burst. *Peyer's glands* (Fig. 9) are apparently mere aggregations of

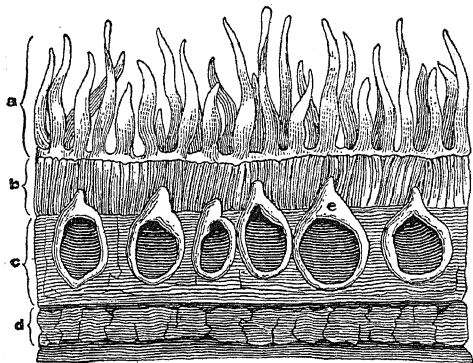


FIG. 9. Vertical section through a patch of Peyer's glands in the dog.

a, villi; b, tubes of Lieberkühn; c, submucous tissue, with the glands of Peyer imbedded in it; d, muscular and peritoneal coats; e, apex of one of the glands projecting among the tubes.

solitary glands, forming oval patches in the ileum. These patches vary in size and number, being largest towards the cæcum, where their long diameter sometimes measures 3 or 4 inches, and smallest towards the jejunum, where their number varies from 15 to 20, or even more. Nothing certain is known regarding the uses of these solitary or aggregated glands; but, as they are largest during the digestive process, we must infer that they are in some way connected with that function. Possibly the peculiar odor of the feces may be due to their secretion. In typhoid or enteric fever and in phthisis these glands become ulcerated, which probably occasions the diarrhœa so common in these diseases.

Brunner's glands are much more developed in the herbivora than in the carnivora; Peyer's on the other hand, are most developed in the latter.

We have endeavored to give the reader some idea of the complicated structure of the mucous and submucous coat of the small intestine; we now proceed to notice the chief uses of the muscular coat of the intestine. This coat consists of two layers of muscular fibres, circular and longitudinal, of which the former lie next to the submucous coat. The peristaltic or vermicular action, by which the substances which enter the duodenum from the stomach are moved onward, is due to this muscular coat. This movement commences in the pyloric third of the stomach, whence successive wavelike movements are propagated through the entire length of the intestinal canal. It is the rapid succession of these alternate contractions and relaxations that impels the intestinal contents onward and occasions those movements which, from their resemblance to the writhings of a worm, have been termed *vermicular*. It is very probable that the rapidity of this movement varies in different individuals—those persons, e.g., whose bowels act twice daily having a more

rapid vermicular motion than those in whom the act of defecation occurs only once in the 24 hours.

We have now to consider the effects produced on the chyme by the different fluids with which it becomes mixed in the small intestine. These fluids are: (1) the bile; (2) the pancreatic juice; and (3) the intestinal juice.

The bile (q.v.) is a faintly alkaline or neutral fluid, containing two essential constituents, one of which is of a resinous nature, while the other is a pigment. The resinous constituent is not precisely identical in all kinds of bile, but it generally consists of a sodium salt whose acid is either glycocholic or taurocholic acid, or of a mixture of these salts. Strecker, to whom we are mainly indebted for our knowledge of the chemistry of the bile, states that in most mammals the resinous constituent merely differs in the varying proportions in which the taurocholates and glycocholates are intermixed, the former usually preponderating. According to Lehmann, the resinous constituent amounts to at least 75 per cent of the solid residue. The bile pigment occurs in the bile of different animals under two forms, viz., as a brown and as a green pigment, the latter probably only differing from the former in being more highly oxidized. There has never been a case in which physiologists have had an opportunity of directly observing the quantity of bile that is secreted by the human subject, and all information on this subject is derived from observations on animals in which the common bile duct (see LIVER) has been tied and a fistulous opening established into the gall bladder. If the same proportion of bile to bodily weight holds good in man as in the dog, a man weighing 140 pounds would secrete daily about 5 pounds of bile. All observers agree that the amount of the biliary secretion varies directly with the quantity of food; and as animals with biliary fistulæ (in whom all the bile escapes externally, instead of making its way into the duodenum) usually have voracious appetites, experiments on this point are easily made. There is great discrepancy of opinion as to how soon after a meal the bile flows most abundantly into the intestine. According to Kölliker and Müller, whose experiments were made on dogs fed only once a day, very little bile is secreted in the first and second hour after a meal, more in the third, fourth, and fifth, the maximum being sometimes attained in the fifth, sometimes not till the eighth hour.

Numerous views have at different times been advanced regarding the functions of this fluid; we shall here notice only those functions which are connected with digestion. One use that has been ascribed to it is to neutralize in the small intestine the acid chyme which emerges from the stomach. But the bile can contribute little or nothing to the neutralization of the free acid, because, in the first place, the bile is very slightly alkaline and often perfectly neutral; and, secondly, because the chyme in the intestine is still acid after the admixture of the bile. Again, the bile has been asserted to possess a special solvent action on the chyme; but none of the ordinary constituents of the latter seem to be essentially changed, even when digested for a long time with fresh bile. Much importance has been attached to the antiseptic action of the bile on the contents of the intestinal canal, in favor of which view it is alleged that



when no bile is poured into the intestine the feces have a putrid odor, as is sometimes observed in patients with jaundice, and as was noticed by Frerichs in animals in which the common bile duct had been tied. Another use assigned to the bile is that it exerts a stimulating action on the intestinal walls and thus acts as a natural purgative; and in support of this view it may be mentioned that jaundice (in which the bile does not flow into the intestine) is often accompanied by extreme constipation, and that purified ox gall, taken either in the form of pill or enema, produces an undoubted purgative action. But the main use of the bile seems to be to promote the digestion of fatty matters; and it accomplishes this end not so much by any solvent chemical action on the fats (which at most is extremely slight) as by a peculiar physical action both on the fats and on the intestinal walls, disintegrating the former and impressing on the latter (by moistening the villi) a peculiar condition which facilitates the absorption of fatty matters. This view is fully confirmed both by direct experiments out of the body and by comparing the relative qualities of fat that are retained in the body and applied to the purposes of life by animals with biliary fistulous openings and by healthy animals.

The pancreatic fluid which is poured into the duodenum at the same spot with the bile (see Fig. 1) is a colorless, clear, somewhat viscid and ropy fluid, devoid of any special odor, and exhibiting a strong alkaline reaction. This fluid, as yielded by different dogs with permanent fistulous openings, varies considerably in chemical composition, the collective solid constituents ranging from 1.5 to 2.3 per cent, the organic matters from 0.9 to 1.6, and the mineral matters from 0.62 to 0.75.

The most abundant and important of the solid constituents is a peculiar substance termed *pancreatin*, or pancreatic diastase or ferment, in combination with soda, to which this fluid owes its principal chemical and properties. Calculating from the quantity of pancreatic juice secreted by dogs of known weight, we may infer that a man weighing 140 pounds secretes daily about 10 ounces of this fluid.

One of the chief uses of the pancreatic juice in relation to digestion is to convert into sugar the amylaceous or starchy matters which have escaped the action of the saliva and have passed unchanged into the duodenum. It possesses this property in a far higher degree than the saliva, and, as might be expected in reference to this use, the pancreas is found to be much more developed in herbivorous than in carnivorous animals. Bernard believes that it is solely by the action of this secretion that the fat is reduced to a condition in which it can be absorbed and digested, i.e., that it is decomposed into glycerin and a fatty acid. (See Table.) This view has, however, not been generally accepted, and it seems probable that, although the change described by Bernard takes place when fat and pancreatic juice are simply mixed together in a test tube, it does not actually take place in the intestine, the acid gastric juice probably acting as an interfering agent. Attempts have been made by Corvisart and Meissner to prove that, like the gastric juice, this fluid can dissolve albuminous matters; but this view cannot be substantiated. Considering the large quantity

of pancreatic fluid which is yielded in 24 hours, Schmidt is of opinion that the function of this fluid is not so much to promote the conversion of starch into sugar as for the purpose of diluting the chyme, and for reconverting the soda (which in the pancreas has been separated from the chlorine of the chloride of sodium and has combined with the pancreatin) into chloride of sodium. He shows, from numerical calculations, that more than half of the chloride of sodium existing in the blood which circulates through the pancreas is broken up into hydrochloric acid and soda, of which the former is separated by the gastric glands, while the latter unites with the pancreatin. Meeting again in the duodenum, the hydrochloric acid and the soda reunite and reform chloride of sodium, which is again absorbed and reenters the circulation. This is perhaps one of the most singular decompositions and reunions occurring in the animal body.

Of the last of the fluids poured into the intestine and coöperating in the digestive process, the *intestinal juice*, we know comparatively little. It is the aggregate secretion of the various glands which we have described as occurring in the walls of the small intestine. It is a colorless, or sometimes yellowish, ropy, viscid fluid, which is invariably alkaline. We are not aware of any special characteristic constituent in it, such as occurs in the other chylipoietic fluids. Its daily quantity is probably 9 or 10 ounces. It seems to unite in itself the leading properties of the pancreatic and gastric juices: i.e., it resembles the former in converting starch into sugar, and the latter in dissolving flesh and other albuminous bodies.

We shall conclude this part of the subject with a few remarks on the chemical composition of the contents of the small intestine. On laying open the gut we usually find a semisolid admixture of imperfectly digested and indigestible substances, and of the constituents of the digestive fluids in a more or less changed condition. The reaction of this mass varies in different parts of the canal and in some measure with the nature of the food. Thus, the contents of the stomach always redden litmus paper, whatever kind of food has been taken; the duodenal contents are also always acid, but in a far less intense degree; in the ileum we meet with only a faint acid reaction, which altogether disappears in the ileum; while in the cæcum, and sometimes in the lower part of the ileum, an alkaline reaction occurs. After a purely animal diet the acid reaction disappears shortly below the duodenum; while, after the sole use of vegetable food, it may sometimes be traced even to the cæcum. As a general rule, the contents of the large intestine are alkaline.

In consequence of the rapid absorption that goes on along the intestinal surface we meet with a comparatively small amount of soluble matters in these contents. Among these soluble matters we often find glucose (or grape sugar), which seems to owe its origin to the metamorphosis of starch, and not to sugar having been present in the food; for after saccharine food has been taken we rarely meet with it in any quantity in the small intestine, its absorption taking place with great rapidity. In the alcoholic extract of these contents we can almost always find evidence of the presence of biliary constituents. In the duodenum, and for a little way beyond it, we find glycocholic and tauro-

cholic acid; descending a little farther, they rapidly diminish, till we find the products of their disintegration; while in the large intestine little more than a trace of these products can be detected. These

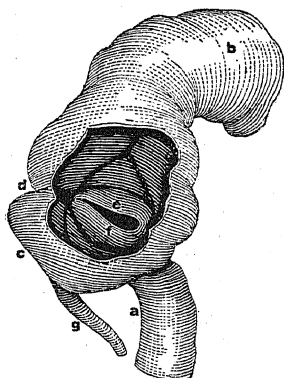


FIG. 10.

Cæcum inflated, dried, and opened to show the arrangement of the valve.

a, termination of the ileum; b, ascending colon; c, cæcum; d, a transverse constriction projecting into the cæcum; e f, lips of the valve separating the small from the large intestine; g, the vermiform appendix of the cæcum.

chemical observations confirm the experiments of Schmidt, which show that nearly half the bile which is poured into the duodenum is decomposed before it reaches the middle of the small intestine.

7. We have now arrived at the seventh stage of the digestive process, that of *defecation*. The line of demarcation between the small and large intestine is very obvious, and by the peculiar arrangement of the ileocecal valve (see Fig. 10) matters are allowed to pass forward with facility, while regurgitation is impossible. (For anatomical details regarding the large intestine, see ALIMENTARY SYSTEM; CÆCUM; COLON.) The contents of the large intestine differ very materially from those just considered and constitute the *fæces*. They are more solid and homogeneous and are often molded into a definite shape by the cells of the colon. The only essential change which the contents undergo in this part of their course is that they increase in solidity, in consequence of the absorption of fluid from them by the mucous membrane. They are propelled forward into the rectum by the vermicular action already described. Here they accumulate, being prevented from escaping by the contraction of the sphincter muscle—a band of strong muscular fibres surrounding and closing the gut at its lower extremity. The act of defecation, or of expulsion of the *fæces* from the rectum, is effected partly by the muscular fibres of that part of the intestine which are stimulated to contraction by a certain degree of distention, and which are to a certain extent under the influence of the will, and partly by the simultaneous contractions of the abdominal muscles and of the diaphragm, which, by reducing the anteroposterior and transverse diameters of the abdominal cavity, compress the intestinal canal in such a manner as greatly to assist the expulsive action of the rectum. These forces, or some of them (for usually the detrusive action of the muscular fibres of the rectum is sufficient), overcome the passive contraction of the sphincter, and the act of defecation is the result. See FÆCES.

8. The absorption of the chyle forms the completion of the digestive act. The coats of the intestines contain two perfectly distinct sets of vessels—one through which blood circulates, and the other containing a milky or transparent fluid, chyle, or lymph, which after a somewhat circuitous route is poured into the blood. We have already referred to the fact that fluids are absorbed from the stomach and intestine by the

veins and capillaries of the mucous membrane; we now proceed to notice the mode in which the vessels of the second kind—the lacteals—act as absorbing agents. The lacteals are merely a portion of the great lymphatic system of the body, which will be described in a future article. (See LYMPHATIC.) They commence in the villi and possibly also in the intervening mucous membrane; and when an animal is killed while the digestive process is going on, they have, in consequence of their being distended with chyle, the peculiar white or milky appearance which procured for them their name of *vasa lactea*, given by their discoverer, Asellius, in 1622. They pass in great numbers, and in a reticulated arrangement, between the layers of the mesentery, the portion of peritoneum (q.v.) which surrounds the gut and retains it in its proper position. After passing through the mesenteric glands, where their contents seem to become more highly organized, they make their way to the right side of the aorta in the lumbar region, where they finally discharge themselves into an elongated pouch, termed the *receptaculum chyli*. From this pouch the thoracic duct, containing the chyle, passes upward along the vertebral column till it reaches the level of the arch of the aorta, behind which it runs to the left side and discharges its contents into the subclavian vein, close to its origin with the internal jugular, its orifice being protected by two valves. (See CHYLE.) Chyle is in reality incipient blood, which has been formed from the food and has been absorbed from the intestine by the lacteals. We have now traced it to its entrance into the general circulation, and it only remains for it to pass, in conjunction with the venous blood with which it is mixed, through the lungs, in order to be converted into new and perfect arterial blood, fit for the highest processes of organization. Consult: Hare, *Food Factor in Disease* (2 vols., London, 1905); Clarke, *Indigestion* (New York, 1906); Roger, *Alimentation and Digestion* (Paris, 1907); id., *Digestion and Nutrition* (ib., 1910); Taylor, *Digestion and Metabolism* (Philadelphia, 1912).

**DIG'GER.** A collective term, without ethnic significance, formerly applied to a number of Indian tribes in central California and the adjacent portion of Nevada, probably from their root-digging habit or from their "dugout" dwellings. See SHOSHONEAN STOCK; MAIDU.

**DIGGER WASP.** See MUD WASP.

**DIGGES**, digz, SIR DUDLEY (1583-1639). An English diplomatist and jurist, son of Thomas Digges. He was born at Barham, Kent, graduated at Oxford in 1601, and was knighted in 1607. In 1618 he went to Russia and in 1620 to Holland as special Ambassador, but later fell into disfavor through his independent opinions. He was a large shareholder in the East India Company. He was the author of *Rights and Privileges of the Subject* (1642) and *The Compleat Ambassador* (1655). He sat in Parliament for Tewkesbury from 1624 to 1626 and for Kent in 1628.—His son DUDLEY (1613-43), a devoted Royalist, was the author of *The Unlawfulness of Subjects Taking up Arms Against Their Sovereign* (1643).

**DIGGES**, LEONARD (?-c.1571). An English mathematician, born at Barham, Kent, and educated at University College, Oxford. He became an expert land surveyor and a well-known architect. He was the author of *A Booke Named*



*Tectonicon* (1556), on measuring land, etc.; *Pantometria: A Geometrical Practise* (1571); and *A Prognostication Everlasting* (1553-56), an astrological work.

**DIGGES, THOMAS** (?-1595). An English mathematician, the son of Leonard. He was educated at Cambridge and entered Parliament in 1572. He constructed the alterations and fortifications of Dover harbor, served as muster-master-general of the English forces in the Netherlands in 1593-94, and was interested in a search for the dominions of the great "Cam of Cathaia," in the Antarctic seas. He edited his father's *Pantometria* and wrote a great many treatises on science and military engineering.

**DIG'GORY.** An awkward servant in Goldsmith's *She Stoops to Conquer*.

**DIGHTON** (dī'tn) **ROCK.** A greenstone boulder near Dighton, Mass., bearing an inscription which has been much discussed by antiquarians. A drawing of the inscription was made by Dr. Danforth in 1680, another by Cotton Mather in 1712, and others in 1730, 1768, 1788, 1790, 1807, and 1812. In 1830 the Rhode Island Historical Society made a careful study of the inscription, which was interpreted by Rafn (*Antiquitates Americane*, Copenhagen, 1845, pp. 357-360) as Norse. The rock was reexamined by Dr. Hoffman for the Bureau of Ethnology in 1886, and the inscription was reproduced and discussed by Mallery in the tenth annual report of the bureau (1888-89, pp. 85, 762, and pl. liv). The inscription is now nearly obliterated. It was probably an Indian petroglyph.

**DI GIACOMO**, dē jā'kō-mō, **SALVATORE** (1862-). A Neapolitan poet and dramatist, born in Naples. He devoted himself as a scholar to the history of his native city, the popular life of which has found in his poems and plays its most masterly interpretation. His plays '*O voto*, '*A "San Francisco," 'O mese mariano*, *Assunta Spina*, and *Quand l'amour meurt*, written in the Neapolitan dialect, and the subjects of which are treated in sonnet form in the *Poesie* and as Italian *novelle* in *Nella vita*, have enjoyed great vogue in Italy, Germany, and France, and rank among the masterpieces of modern regional literature. His collected works are published (Lanciano, 1910).

**DIGIT**, dij'it (Lat. *digitus*, finger). A term applied to the 10 symbols of number, 0, 1, 2, . . . 9. Thus, 305 is said to be a number of three digits. Early races were accustomed to indicate numbers by their fingers, and finger reckoning (see **FINGER SYMBOLISM**) played a great part in mediæval computation; hence the name "digit." Originally the term was applied more generally to the nine numbers, 1, 2, . . . 9, and it has also been applied to the characters themselves. The term occurs in a work attributed to Boëthius and was common throughout the Middle Ages, the numbers 10, 20, . . . 90 being called articles, and combinations of articles and digits being called composites. Astronomers use the term "digit" to signify a twelfth part of the diameter of the sun or moon and speak of an eclipse of seven digits, meaning that seven-twelfths of the diameter is covered. See **NUMERALS**.

**DIGITALIN**, dij'i-tā'lin (from Neo-Lat. *digitalis*). A substance extracted by alcohol from the leaves of the foxglove (*Digitalis purpurea*), growing in Europe. The alcoholic solution is precipitated with water, and the precipitate is

extracted with chloroform, in which digitalin is quite soluble. Digitalin is a crystalline substance sparingly soluble in water and in ether and constitutes one of the active principles of digitalis. The commercial *Homolle's Digitalin*, or *Quévenne's Digitalin*, consists largely of digitalin and is used in France as a substitute for digitalis leaves. The substance known as *Nativelle's Digitalin* has in recent years been recognized as a mixture, consisting principally of *digitonin*, another poisonous glucoside.

**DIGITALIS**, dij'i-tā'lis (Lat. *digitalis*, pertaining to the finger, from *digitus*, finger; in allusion to the shape of flowers). A genus of plants of the natural order Scrophulariaceæ (Linné), tribe Digitaleæ, natives chiefly of the south of Europe and western and middle Asia, characterized by a five-cleft calyx, campanulate, ventricose corolla, upper lip reflexed, capsule two-celled, flowers in showy racemes. One, the common foxglove (*Digitalis purpurea*), is a native of Great Britain and is very abundant in some parts of the country, its large purple flowers often giving a gay appearance to dry banks and steep hills. The purple-flowered, white-flowered, and yellow-flowered varieties are cultivated in America. *Digitalis purpurea* is much valued in medicine. The leaves of the second year's growth are the parts used. They



FOXGLOVE.

are narcotic and poisonous. The leaves have a disagreeable smell when fresh, and a bitter, nauseous taste, and are violently emetic and cathartic, but, when dried and administered in small doses, they are diuretic, and therefore sometimes useful in dropsy; they are still more

valuable on account of their power over the action of the heart and the circulation of the blood, and are used in some diseases of the heart, in the second stage of pneumonia, in cardiac weakness from collapse, and as the antidote in aconite poisoning. Digitalis owes its efficiency to various alkaloids and other substances, some crystalline, known as digitalin, digitalein, digitoxin, digitonin, and digitin. Digitoxin probably is the actively poisonous agent. Digitalin fulfills all the offices of digitalis in influencing the heart and the circulatory system and is less dangerous. But the drug should never be given except by a physician, who alone can use it safely. In some types of heart disease it is dangerous. In some cases it has a cumulative action resulting in acute poisoning and often in death. The official preparations of digitalis are a tincture, an infusion, a fluid extract, a solid extract, and the powdered leaves.

**DIGITIGRADA**, dij'i-tī-grā'dā (Neo-Lat. nom. pl., from Lat. *digitus*, finger, toe + *gradi*, to walk). In the zoölogical system of Cuvier, one of the tribes of Carnivora, distinguished by walking on the toes alone, the heel not touching the ground. The word is no longer used as the name of a group, but in the adjective form describes those animals which walk wholly on the toes as opposed to "plantigrade," or walking on the whole sole of the foot. Most mammals are more or less completely digitigrade.

**DIGITORIUM**, dij'i-tō'ri-ūm. See PIANO-FORTE.

**DIGNE**, dé'ny' (Lat. *Dinia*, Gall. *din*, fort). The capital of the Department of Basses-Alpes, France, at the junction of the Bléonne and the Durance, 60 miles northeast of Marseilles (Map: France, S., L 4). It occupies a picturesque situation at the foot of a mountain slope and is encircled by walls, but its streets are narrow, crooked, and steep. It contains a cathedral, a handsome modern lycée, and a public library. It is the centre of a rich fruit district. Among its chief manufactures are articles of leather, and it has a trade in dried fruits, comfits, marble, honey, wax, woolen and linen cloth, kid skins, etc. In the neighborhood there are several hot saline springs; temperature, 104° F. Of *Dinia*, which is mentioned by Pliny, nothing remains. It embraced Christianity at an early period and has given title to a bishop since the year 340. In 1629 a plague reduced the population from 10,000 to 1500. Pop., 1901, 7238; 1911, 7317. Guichard, *Souvenirs historiques sur la ville de Digne et ses environs* (Digne, 1847).

**DIGNITY**. In English law, a title of honor or nobility. Such titles are regarded as a species of property, and are classified by Blackstone as incorporeal hereditaments, which, on the death of the owner, pass, like the rest of his real estate, to his heir and not to his personal representative. Like lands, also, dignities are held of the crown, to which they revert by escheat on the failure of heirs, whereupon they may be granted, like escheated lands, to another. The English law recognizes also a species of inferior dignity, as knight, sergeant at law, and esquire, which are not generally inheritable. A superior dignity, or title of nobility, may be employed in legal proceedings without the surname of the bearer, and in early English law the omission of the title or "addition" of a party in a suit was sufficient ground for the abatement of the action. See NOBILITY; TITLES OF HONOR.

**DIGONEUTISM**. This phenomenon has

been observed in butterflies by Scudder. It is, stated briefly, the result of summer dormancy in the larva or of prolonged life in the pupa. Owing to this prolongation of life in their preparatory stages, all the butterflies of one and the same brood do not appear in the same season, but a portion of the brood flies the next year. Thus, the butterflies belated one year fly and interbreed with their nephews and nieces instead of their brothers and sisters. This is advantageous to the species, since it prevents too close in-and-in breeding.

**DIHEDRAL ANGLE**. See ANGLE.

**DIJKSTRA**, dik'stra, WALING (1821- ). A Frisian poet, born in Vrouwen Parish (Province of Friesland). By his poetic works, in which he shows some similarity to Fritz Reuter, he greatly contributed to the extension of the Frisian language and literature. These include: *Doaitse mei de noardsce balke* (3d ed., 1875); *De silveren rinkelbel* (3d ed., 1887); *In doaze fol alde snypsnaren* (in collaboration with Van der Meulen, 2d ed., 1882); *Friske winterjounenocht* (5 vols., 1861-76). Perhaps his greatest work is *Uit Friesland's volksleven van vroeger en later* (Leeuwarden, 1892).

**DIJON**, dē'zhōn' (Lat. *Castrum Divionense*). A town and seat of a bishopric, capital of the Department of Côte d'Or, France, formerly capital of the old Duchy of Burgundy (Map: France, N., L 5). Dijon occupies a delightful situation in a fertile plain on the right bank of the Ouche, where it meets the Luzon and the Canal de Bourgogne, and at the base of the vine-clad hills which produce the famous Burgundy wines, 211 miles southeast of Paris by rail. It is protected by a chain of eight forts. The environs are exceedingly beautiful. Dijon is surrounded by old walls, originally having five gates; the ramparts, planted with trees, have been converted into fine boulevards and promenades. The town is well and regularly built of freestone, and the streets are spacious and clean. Among the public buildings, which are numerous and imposing, the chief are the cathedral of St. Rémi, a massive Gothic structure, dating from the thirteenth century, with a tall wooden spire, more than 300 feet high; the church of Notre Dame, a fine specimen of fourteenth-century Gothic architecture; the church of St. Michel, with a splendid Renaissance front; the theatre, a handsome building having an excellent Corinthian portico; and the palace of the dukes of Burgundy, now used as the town hall. The outside of the palace has been rebuilt, but its internal decorations still survive in their pristine beauty. The museum located in it is rich in monuments of the Middle Ages. Dijon is the seat of a university with three faculties—law, science, and letters—and a library with over 80,000 volumes and 900 manuscripts, and possesses, in addition, a royal college, a theological seminary, a botanic garden, and an academy of art. The manufactures consist of woolen cloth, blankets, hosiery, leather, vinegar, chemical products, cooperage, shoes, flour, machinery, and automobiles; and there are salt refineries, distilleries, and breweries, but the town is mainly dependent on its trade in the wines of Burgundy. It is famous for its mustard and gingerbread. Pop., 1906, 74,113; 1911, 76,847. Dijon dates from Roman times. It came into the possession of the Burgundians in the fifth century and from them passed to the Franks. In the ninth century it was ruled by counts of its

own, under the suzerainty of the bishops of Langres. In the eleventh century it was united to the Duchy of Burgundy, of which it became the capital, and the residence of the dukes, who rebuilt, enlarged, and beautified it. On the death of Charles the Bold (1477) it was annexed to the crown of France by Louis XI. Dijon is the birthplace of Bossuet, the elder Cr  billon, Rameau, Rude, and Jouffroy the sculptor. Consult Jos. Garnier, *Chronique de l'abbaye Saint-B  nigne de Dijon* (Dijon, 1876); H. Chabeuf, *Dijon    travers les   ges* (ib., 1894).

**DIKE**, or **DYKE** (AS. *dic*, Icel. *dik*, MHG. *tich*, Ger. *Teich*, pool; probably connected ultimately with Gk. *τεῖχος*, *teichos*, wall). In geology, a relatively thin body of igneous rock occurring between the separated walls of a fissure. It differs from vein, which it resembles in form, in having been formed by the intrusion and consolidation of molten material, and not by the deposition of minerals from solution. Dikes are usually inclined at considerable angles from the horizontal, and, when the adjacent rock has decayed, they project above the surface like walls of masonry. They vary in width from a few inches to hundreds of feet, the larger dikes sometimes extending a distance of many miles; they reach downward to unknown depths. Proof of their igneous origin is found in the great changes wrought by the strata forming their walls have suffered by the intense heat. Limestone in contact with dikes is changed to crystalline marble; shale is hardened to slate, or by the development of new minerals becomes schist; and bituminous coal assumes the character of anthracite. While of wide occurrence, dikes are especially frequent in regions of crustal folding and volcanic disturbance. They are often found traversing the sides of volcanoes, where they originate during eruptions by fissuring of the cone and filling of the cracks with lava. The consolidation of igneous rocks in the form of dikes develops peculiar features of texture, and this fact has been used by some authorities as the basis of a rock class known as "dike rocks." The sudden chilling of the molten mass produces a fine crystalline intergrowth of the minerals, and dike rocks consequently are usually compact and tough. The basic kinds, such as are commonly called "trap," are much used for crushed stone, for roads and concrete. See GEOLOGY; IGNEOUS ROCKS; VOLCANO.

**DIKE**. An embankment of earth, most commonly one used to reclaim or protect lands from flooding or formed in land-drainage. The term is sometimes applied to low earth dams, generally such as are auxiliary to the main dam, forming an artificial reservoir by closing minor outlets from the natural basin. See DAMS; DRAINAGE; LEVEE.

**D  KE** (Gk. *Δίκη*). The embodiment of justice in Greek mythology. She is the daughter of Zeus and Themis, and, with her sisters, Eunomia (Order) and Irene (Peace), is reckoned among the Hor  . She is like the Erinyes in that she avenges wrong, but unlike them in that she rewards virtue. Consult Hirzel, *Themis, Dike, und Verwandtes* (Leipzig, 1907), and Harrison, *Themis: A Study of the Social Origins of the Greek Religion* (Cambridge, 1912).

**DIKE**, *dik*, SAMUEL WARREN (1839-1913). An American Congregational clergyman, prominent as an agitator for reform in the laws of divorce. He was born at Thompson, Conn. He graduated at Williams College in 1863 and at

Andover Theological Seminary in 1866. In 1881 he became corresponding secretary of the Divorce Reform League (now called the National League for the Protection of the Family), which he organized. His writings are mostly in exposition and defense of the principles of the league.

**DIKELL'OCEPH'ALUS** (Neo-Lat., from Gk. *δικελλα*, *dikella*, mattock + *κεφαλή*, *kephal  *, head). A genus of Upper Cambrian trilobites of the family Olenid  . The carapace is broad and flat, the head broadly lunate, eyes elongate reniform, glabella short, thorax broad and flat, with nine segments and low axis, and pygidium large, expanded, and flat, with a sharp triangular spine at each posterior lateral corner. The best-known species, *Dikellocephalus minnesotensis*, with a length of 3 to 8 inches, is very common in certain yellow shales of the Upper Cambrian in Wisconsin and Minnesota. A number of other species from the Cambrian and Lower Ordovician of Europe and North America have been incorrectly placed in this genus, which is considered generally as the index fossil of the Upper Cambrian, or Potsdam horizon. See OLENUS; TRILOBITE.

**DIKOA**, d  -k  '  . A fortified town of the old Kingdom of Bornu, in Central Africa, now included in the German Colony of Kamerun. It is situated in a fertile plain about 25 miles south of Lake Chad. Its population is estimated at about 25,000.

**DILAP'IDATION** (Lat. *dilapidatio*, from *dilapidare*, to waste, from Lat. *di-*, apart + *lapidare*, to throw stones, from *lapis*, stone). In the English law, the waste, destruction, or impairment of the church, parsonage, or other ecclesiastical property, or the woods of a benefice or ecclesiastical estate, by the parson or other incumbent. It is dilapidation to permit the buildings to fall into decay for lack of repair as well as to pull them down, but not to waste the glebe or other lands. The obligation of the incumbent of a church living with respect to waste is therefore less extensive, as it is less severely punished, than in the case of an ordinary tenant for life or years. The next incumbent of the living is the person entitled to bring the action, not however against his predecessor who was guilty of the dilapidation, but, after the death of the latter, against his personal representatives. The damages recoverable are the amount necessary to restore the property to a state of good and substantial repair, and the money so recovered must within two years be expended in such restoration and repair. The subject of dilapidations is now mainly regulated by a series of recent statutes, the most important of which are 34 and 35 Vict., c. 43 (1871) and 35 and 36 Vict., c. 96 (1872). Consult Degge, *Parson's Counselor* (7th ed., chap. viii), and Blackstone's *Commentaries on the Laws of England*.

Waste by a tenant for life or years is sometimes described as dilapidation, but is more properly treated under the former title. See WASTE.

**DILEMI**. The name of a Persian dynasty. See SAMANI and DILEMI.

**DILEM'MA** (Lat. *dilemma*, from Gk. *δῖλημμα*, conclusion from two alternatives, *di-*, double + *λήμμα*, to take). A true dilemma is defined by Whately as "a conditional syllogism with two or more antecedents in the major, and a disjunctive minor." One form of it is represented in the following scheme: If *A* is *B*, *C*, is

*D*, and if *F* is *G*, *C* is *D*; but either *A* is *B* or *F* is *G*, hence *C* is *D*. There being two mutually exclusive propositions in the minor premise, a person must admit one or the other, and is then caught between the "two horns of the dilemma." See **LOGIC**.

**DILETTANTE**, dil'ët-tän'të or dë'lët-tän'tä (It., pres. part. of *dilettare*, to delight). A term in its original sense synonymous with an *amateur*, or lover of the fine arts, science, or letters. It has, however, come into use as suggesting somewhat the trifle, the dabbler in any or all of those arts which, if seriously pursued, make for civilization and true culture. The dilettante, however, may serve a good purpose, and often does, by interesting himself in the patronage of art and the conservation of objects of art. See **DILETTANTI SOCIETY**.

**DILETTANTI SOCIETY**. A body of about 60 private gentlemen by whose exertions the study of antique art in England has been largely promoted. The society was founded in 1734 and was in its beginnings simply an amateur club for social intercourse and cultivation of artistic knowledge; but in 1764 it was resolved to fit out an expedition for the purpose of collecting details and drawings of the most remarkable artistic monuments of antiquity. Four distinguished members were sent to Greece and Asia Minor, and after their return two splendid volumes on the architectural antiquities of Ionia were published at the expense of the society (1769-97). Their attention was next turned to sculpture, then at the lowest ebb in England, and a series of engravings of the finest antique statues, bas reliefs, and busts appeared in 1809, with dissertations by Payne Knight. Two more volumes were issued, one in 1817 entitled *The Unedited Antiquities of Attica*, and a second on *Antique Sculpture* in 1835, and other volumes on Ionian antiquities appeared in 1840 and 1881. For further particulars, consult Cust, *History of the Society of Dilettanti*, ed. Colvin (London, 1898; new ed., 1914).

**DILIGENCE**, dil'i-jens, *Fr. pron.* dë'lë'zhäns' (Fr., from Lat. *diligentia*, attentiveness, from *diligere*, to love, choose, from *di-*, apart + *legere*, to choose). A name used in France and Russia for a public conveyance resembling a stagecoach. It was a huge, strong-built vehicle, with 4 broad wheels, weighing with its load about 5 tons, and was drawn by 4 stout horses, at the rate of about 6 miles an hour. It consisted of 3 chief compartments: the front, called the *coupé*, for 3 persons; the second, called the *intérieur*, for 6 persons; and, lastly, the *rotonde*, entered from behind, for 6 persons. Aloft, in front, was the *banquette*, where the *conducteur* was seated; and behind this, underneath a thick leather covering, passengers were sometimes huddled among luggage and goods, with little regard to their comfort. All the places in the body of the vehicle were numbered and assigned in the order of booking. Usually an effort was made to be booked early, in order to secure corner seats. In booking it was customary to pay only a portion of the fare, called *arrhes* ('earnest money'), the remainder being paid at the end of the journey. The driver being concerned only with the horses, the entire management of the vehicle, including the charge of the drag or break, devolved on the *conducteur*, a personage dressed in a blue cloth jacket and cap, and having a badge on his breast indicative of his dignity. In France the diligence system

has become obsolete with the development of railways, but in Russia this curious vehicle may still be seen plying between towns unconnected by rail or water.

**DILKE**, dilk, CHARLES WENTWORTH (1789-1864). An English critic and antiquary. He graduated at Cambridge, was for many years an official in the navy pay office, and from 1830 to 1846 edited the *Athenæum*, of which he had in the former year become proprietor. He edited *Old English Plays* (6 vols., 1814-16). In 1846-49 he managed the *Daily News*. He was a friend of Keats, Hood, Leigh Hunt, Barry Cornwall, and Lamb, and between 1847 and 1864 wrote for the *Athenæum* a number of valuable literary essays, collected as *Papers of a Critic* (2 vols., 1875). He gathered biographical data regarding Pope and other English authors, and from time to time presented his findings in *Notes and Queries* and elsewhere.

**DILKE**, SIR CHARLES WENTWORTH (1810-69). An English politician, born in London and educated at Cambridge. He was a zealous promoter of the great International Exhibition of 1851 and was one of the English commissioners of the New York Industrial Exhibition of 1853. He was also one of the five royal commissioners for the Exhibition of 1862 and shortly afterward was made a baronet. In 1865 he was a member of Parliament, and in 1869 representative of Finsbury at the St. Petersburg Horticultural Exhibition. A collection of his writings, *Papers of a Critic* (2 vols., 1875), contains a biographical sketch by his son.

**DILKE**, SIR CHARLES WENTWORTH (1843-1911). An English politician and author, born at Chelsea, the grandson of Charles Wentworth Dilke (q.v.). He graduated at Cambridge in 1866, traveled extensively in the United States, Canada, and the British countries in the East, and embodied his observations in *Greater Britain: A Record of Travel in English-Speaking Countries during 1866-67* (1868). He represented Chelsea in Parliament from 1868 to 1886, was Undersecretary of State for Foreign Affairs from 1880 to 1882, and was President of the Local Government Board from 1882 to 1885. Always a Radical, he was fiercely attacked in the seventies for his avowed republicanism. Among the reform measures carried by him was the one giving the municipal franchise for women. In 1881 he was chairman of the Royal Commission on the Housing of the Working Classes. In 1886 a Mr. Crawford secured a divorce from his wife, and Sir Charles Dilke as correspondent. During the trial, he was elected member of Parliament for Chelsea, it being understood that he would resign if the verdict went against him. He retired from public life, but in 1892 took a seat in Parliament for the Forest of Dean, with much of his old prestige as a leader but remaining out of office. He succeeded his father and grandfather as proprietor of the *Athenæum* and became the owner of *Notes and Queries*. Besides the work already mentioned, he published a clever political satire called *The Fall of Prince Florestan of Morocco* (1874); *The Present Position of European Politics* (1887); *Problems of Greater Britain* (1890); *Imperial Defence* (1892; with Spenser Wilkinson), and *The British Empire* (1898); edited his grandfather's *Papers of a Critic*; and prefixed a memoir of his wife (see the next title) to *The Book of the Spiritual Life* (1905).

**DILKE, LADY EMILIA FRANCES STRONG** (1840-1904). An English author, born at Ilfracombe. She became a contributor to the *Saturday Review* in 1864 and subsequently was for many years fine-art critic of the *Academy*. In addition to numerous articles in periodicals, she published: *The Renaissance of Art in France* (1879); a biography of Lord Leighton (1881, in Dumas's "Modern Artists Series"); *Art in the Modern State* (1884); *French Painters of the Eighteenth Century* (1899); *French Architects and Sculptors of the Eighteenth Century* (1900); *French Engravers and Draftsmen of the XVIIIth Century* (1902); *Book of the Spiritual Life*, with memoir of the author by Sir C. W. Dilke (1905).

**DILL** (AS. *dile*, OHG. *tilli*, Ger. *Dill*, from Dutch *dille*; origin obscure), *Anethum*. A genus of plants of the family Umbelliferae, having compound umbels without general or partial involucres. *Dill* (*Anethum graveolens*) is an annual or biennial plant, which grows wild in grain fields in the East and in the countries around the Mediterranean. It is quite hardy in Great Britain and is cultivated and growing wild to some extent in the United States. It has from a very early period been in general cultivation as an aromatic stimulant and carminative. It has a stem 1 to 4 feet high, bearing at top a flat umbel of 10 to 30 rays; the leaves much divided, and the final segments threadlike. It has strong, peculiar aromatic smell and taste; the leaves and fruits are extensively used for flavoring pickles, sauces, etc. The fruit (dillseed) is used in medicine, chiefly for relief of flatulence in infants, and is administered in the form of dill water in the preparation of which oil of dill is employed—a pale-yellow essential oil, on which the properties of the plant depend, and which is obtained by distillation. Sowa dill (*Anethum sowa*), now considered as identical with the preceding, is a native of Bengal, and is much cultivated in the East Indies for its fruit, which is variously used in medicine and flavoring. It is a common ingredient in curries. The plant much resembles common dill, but its flavor is stronger.

**DILL, LUDWIG** (1848- ). A German landscape and marine painter. He was born at Gernsbach (Baden) and studied engineering and architecture before taking up painting at the Munich Academy under Raab, Seitz, and Piloty. He was first influenced by Lier and the Barbizon painters, and afterward, during a sojourn in Italy, by Baisch. The works of his earlier period, largely marines and fishing scenes painted on the island of Chioggia, are characterized by great breadth of handling. A good example is "Sirocco" (Mannheim Gallery). After a visit to Holland he returned to Munich and took up his residence at Dachau, where he continued to spend part of each year. He devoted himself to pure landscape and under the influence of the Scottish school gradually developed greater realism and subdued yet luminous effects of color. His latest works are expressions of mood rather than direct interpretations of nature. Among the best are: "Meadows" (Pittsburgh Gallery); "Sacred Grove" (Munich); "A Brook in the Moor" (Dresden); "A Corner of the Giudecca" (1910); "A Canal" (Mühlhausen); "November" (Munich). One of the founders of the Völkisch organization, he

was its president from 1894 to 1899, and in 1897 he founded, with Hölzel and Langhammer, the so-called "Dachau Group." He was one of the judges at the Chicago and Paris expositions and became a professor at the Karlsruhe Academy. Consult Rössler, *Neu-Dachau* (Bielefeld, 1905).

**DILL, SIR SAMUEL** (1844- ). A British educator and historian of Roman society. He was educated at Queen's College, Belfast, and at Lincoln College, Oxford, where he was lecturer in 1869. He was fellow, dean, and tutor of Corpus Christi in 1869-77, head master of Manchester Grammar School in 1877-88, after 1889 Commissioner of Intermediate Education for Ireland, and in 1913 chairman of the vice-regal committee on primary education. His *Roman Society in the Last Century of the Western Empire* (1898) and *Roman Society from Nero to Marcus Aurelius* (1905) treat more than capably a topic of which there is hardly any other systematic summary, and carry on Friedländer's *Sittengeschichte Roms*.

**DILLENBURG**, dil-len-burg. The capital of the circle of Dill, Hesse-Nassau, Prussia, picturesquely situated on the Dill, 21 miles southwest of Marburg (Map: German Empire, C 3). The Wilhelmsturm, a tower 130 feet high, now occupies the site of the ancient Dillenburg Castle, in which was born William of Orange, liberator of the Netherlands, in 1533. Iron mining is the chief industry; leather tanning is also carried on. A mining school is one of the educational institutions. Pop., 1900, 4470; 1910, 5371.

**DILLENIUS, or DILLEN, JOHANN JAKOB** (1687-1747). A German-English botanist. He was born at Darmstadt, Germany. After holding a professorship at the University of Giessen he went to England (1721) and was in charge of the celebrated Sherard Botanical Gardens at Eltham, Kent, for several years. In 1734 he was appointed Sherardian professor of botany at Oxford, where he remained until his death. His work on mosses, entitled *Historia Muscorum in qua circiter Sexcentis Species Veteres et Novae ad sua Genera Relatae Describuntur* (1741; reprinted, 1811), was long accepted as the standard authority on the subject. Consult Schilling, *Johann Jakob Dillenius* (Hamburg, 1888).

**DILLER, JOSEPH SILAS** (1850- ). An American geologist, born at Plainfield, Pa. He studied at Harvard University and at Heidelberg, Germany. From 1881 to 1883 he served as geologist to the Assos expedition. In 1883 he was appointed to the staff of the United States Geological Survey. He wrote numerous papers and monographs, chiefly relating to the Pacific coast region, including: *Geology of the Lassen Peak District* (1889); *The Coos Bay Coal Field* (1899); *Geology and Petrography of Crater Lake National Park, Oregon* (1902), etc. etc. in the latter work with H. B. Patton.

**DILLINGEN**, dil-ling-en. A town of Bavaria, on the Danube, 24 miles northwest of Augsburg. Its principal buildings are the palace, royal gymnasium and Latin school, a library of 75,000 volumes, a Capuchin monastery, a Franciscan nunnery, and a deaf and dumb asylum. The University, which was founded in 1544 and became one of the chief seats of the Jesuits, was suppressed in 1804 and is now a royal lyceum. There are manufactures of cutlery, cloth, paper, and twine, but the prin-

cipal pursuits are . . . Pop., 1890, 5775; 1900, 6077; . . . In the Middle Ages the town was the seat of the counts of Dillingen, and from 1286 until 1803, when it came into the possession of Bavaria, it belonged to and was the residence of the bishops of Augsburg.

**DILLINGHAM, WILLIAM PAUL** (1843-). An American lawyer and Republican politician, born at Waterbury, Vt., son of Paul . . . Governor of the State in 1865-67. He was admitted to the bar in 1867, was Secretary of Civil and Military Affairs of Vermont in 1866 and 1874-76, a member of the Lower House of the Vermont Legislature in 1876 and 1884, and of the Senate in 1878 and 1880. In 1888-90 he was Governor of the State and in 1900 was elected to the United States Senate to take the seat of Justin S. Morrill (q.v.) and was reelected for the terms 1903-09 and 1909-15. In 1907 he was chairman of the United States Immigration Commission.

**DILLMANN, dīl'mān, CHRISTIAN FRIEDRICH AUGUST** (1823-94). A German Orientalist and theologian. He was born at Illingen, Württemberg, and educated at Tübingen, where in 1852 he became lecturer. In 1854 he became professor of Oriental languages at Kiel, and in 1864 professor of Old Testament exegesis at Giessen. He became professor of Old Testament exegesis at the University of Berlin in 1869, and in 1877 a member of the Royal Academy of Sciences. He is noted for researches in the Ethiopic language, of which he published a . . . (1857; revised by Bezold, 1899), a . . . (1865), and parts of the Ethiopic Bible (1853-94). Contrary to the views of most modern critics, he argued that the Priestly Codex was pre-Deuteronomic. He wrote commentaries on Job (1869; 4th ed., 1891); Exodus and Leviticus (1880; 3d ed., 1897); Genesis (1875; 6th ed., 1892; English, 1897); Numbers, Deuteronomy and Joshua (1886); Isaiah (1890); and published: *Ursprung der alttestamentlichen Religion* (1865); *Die Propheten nach ihrer politischen Wirksamkeit* (1868) and, edited by Kittel, *Vorlesungen über Theologie des Alten Testament* (1895). Consult Baudissin's sketch (Leipzig, 1895).

**DILLON, JOHN** (1851-). An Irish politician and agitator. He was born in Dublin, the son of John Blake Dillon (1816-66), a prominent member of the Young Ireland party. Dillon was educated at the Catholic University of Dublin and the Royal College of Surgeons of Ireland. He early identified himself with the Parnellite movement and in 1880 was returned for Tipperary. In Parliament he soon became prominent for the violence of his language, while his connection with the "Plan of Campaign," inciting the Irish tenants to lawlessness, led to his imprisonment in 1888 and 1891. From 1883 to 1885 he was out of Parliament because of ill health; but in 1885 he was elected for East Mayo, which he represented thereafter. He succeeded Justin McCarthy as chairman of the Irish Nationalist party in 1896 and held this position until 1899. He visited the United States on several occasions between 1882 and 1894.

**DILLON, JOHN FORREST** (1831-1914). An American lawyer. He was born . . . Co., N. Y., and early in life . . . where he successively became State prosecuting attorney (1852-58), judge of the Supreme

Court of Iowa (1863-69), and judge of the United States Circuit Court, Eighth Judicial District (1869-79). From 1879 to 1882 he was professor of real estate and equity jurisprudence at Columbia Law School in New York City. He became prominently known as a railroad lawyer and was associated as general or consulting counsel with the Manhattan Elevated and Union Pacific railroad companies and with the Western Union Telegraph Company. His works include: *Municipal Corporations* (1872); *Removal of Causes from State to Federal Courts* (1877); *Laws and Jurisprudence of England and America* (1894); *John Marshall* (3 vols., 1903); *Commentaries on the Law of Municipal Corporations* (revised and enlarged, 1911).

**DILLON, WENTWORTH.** See ROSCOMMON, EARL OF.

**DILOLO, dē-lō'lō, LAKE.** A small lake in Angola, near the southern boundary of Belgian Congo, situated in lat. 11° 30' S., long. 22° 30' E. Its altitude is about 4700 feet. It lies on the watershed between the river systems of the Congo and the Zambezi, with both of which it may be connected. Lake Dilolo was discovered by Livingstone in the beginning of 1854. It abounds in hippopotamuses and fish.

**DILTHEY, dē'l'ti, WILHELM** (1834-1911). A German philosopher. He was born at Biebrich and was educated at . . . and Berlin. He occupied the chairs . . . at Basel in 1866, Kiel in 1868, Breslau in 1871, and Berlin in 1882. In *Einleitung in die Geisteswissenschaften* (1883) he endeavors to furnish a rational basis for the sociological and historical sciences by eliminating metaphysics and substituting psychology as a primary factor. He wrote also *Das Erlebnis und die Dichtung* (1906).

**DILUENTS** (from Lat. *diluere*, to wash away, from *dī*, apart + *luere*, to wash). Medicines whose purpose is to dilute the blood and increase the quantity of the excretions generally. The simplest and best of diluents is pure water; but all watery fluids, such as lemonade, soda water, beer, infusions, tea, etc., may be regarded as . . . this designation.

**DILUVIUM** (Lat. flood, from *diluere*, to wash away). A name formerly given by geologists to those strata which they believed to have been formed by the deluge and more particularly to the boulder clay. When the adjective—diluvial—is employed by modern writers, it is to characterize those accumulations of gravel or angular stones formed during the Pleistocene period. The term is little used by modern writers, except perhaps in Germany.

**DIMAN, JEREMIAH LEWIS, D.D.** (1831-81). An American Congregational . . . He was born in Bristol, R. I., graduated from Brown University in 1851 and from Andover Theological Seminary in 1856 and died in Providence, where he had been professor of history and political economy in Brown University since 1864. He was an able preacher and orator and is remembered by his posthumous publications, *The Theistic Argument* (1881) and *Orations and Essays* (1881). For his biography, consult Caroline Hazard (Boston, 1887).

**DIMANCHE, dē'mānsh', MONSIEUR.** A merchant in Molière's *Don Juan*, who unsuccessfully attempts to collect his bills. The term is in use in France as the synonym for a dun.

**DIME** (OF. *disme*, Lat. *decimus*, tenth, from *decem*, ten). In the United States, a silver coin



whose value is 10 cents, i.e., one-tenth of a dollar. Hence such phrases as "dime novels" and "dime museums."

**DIMENSION** (Lat. *dimensio*, from *dimetire*, to measure off, from *di-*, apart + *metiri*, to measure). In geometry, a line, whether straight or curved, has one dimension, viz., length; a plane surface has two, length and breadth; and a solid has three, length, breadth, and thickness. In algebra the term "dimension" is applied in much the same sense as "degree," to express the number of literal factors contained in a product. Thus,  $x^2$ ,  $xy$ ,  $2ab$  are said to be of two dimensions;  $x^3$ ,  $x^2y$ ,  $\frac{a^2bc}{a}$ , of three; and so on. In

physical measurements the power to which the unit (q.v.) of measure enters determines the dimension of the expression. The form of any material body may be described in terms of at least three dimensions; hence the space in which these forms or figures exist is usually regarded as tri-dimensional. However, the possibility of the existence of a space having more than three dimensions has long been recognized. Such an hypothesis is of service to the mathematician in explaining analytic phenomena. Since points, lines, and surfaces, in general, generate by their motion lines, surfaces, and solids, respectively, it may be inferred that some movement of a figure of three dimensions can generate a figure of four dimensions. Analytically it is only necessary to imagine four parameters or coördinates belonging to each point of four-dimensional space, or five in five-dimensional space, and so on, in order to develop a system of analysis as logical in itself as that of only three dimensions. Figures to represent some features of four-dimensional bodies have been imagined. (See CHASLES; CHARACTERISTIC; GEOMETRY.) On the question of a fourth dimension, consult Schubert, *Mathematical Essays* (Chicago, 1898), and Manning, *The Fourth Dimension Simply Explained* (New York, 1910). A popular discussion may be found in Abbott, *Flatland* (Boston, 1891); Schofield, *Another World* (London, 1890); Hinton, *New Era of Thought* (ib., 1886).

**DIMENSIONS**. All physical quantities, such as force, energy, electric intensity, magnetic poles, etc., admit of mathematical expression in terms of the elementary ideas of physics. Thus, all mechanical quantities can be expressed in terms of mass, length, and duration of time. All electrical and magnetic quantities can be expressed in terms of mass, length, duration of time, and the "inductivity" of matter for electric or magnetic forces. (See ELECTRICITY.) Thus, velocity is defined as the limiting value of  $\Delta x$  to  $\Delta t$  where  $\Delta x$  is the distance traversed in the time  $\Delta t$ ; consequently velocity involves the idea of a number of units of length divided by a number of time units: its "dimensions" are said to be  $\frac{L}{T}$  or  $LT^{-1}$ . If, therefore, on any system

of units, e.g., the C. G. S. system (q.v.), the numerical value of a certain velocity is  $V$ , its value on a system of units in which the unit of length is 10 times as . . . the former system would be  $V/10$ . . . acceleration, or the rate of change of . . . with reference to the time, has the dimensions  $\left(\frac{L}{T}\right) \div T$ , or

$LT^{-2}$ . Force is measured by the product of acceleration and mass; its dimensions are therefore  $LTM^{-2}$ .

In the following table are given the dimensions of various mechanical quantities:

Acceleration . . . . .	$LT^{-2}$
Force . . . . .	$MLT^{-2}$
Pressure . . . . .	$ML^{-1}T^{-2}$
Work	$ML^2T^{-2}$
Energy }	
Moment of force . . . . .	$ML^2T^{-2}$

If  $K$  and  $\mu$  are written for the dimensions of electric and magnetic inductivity, the dimensions of electric and magnetic quantities have the following values. In the first column are given the electrostatic system of units; in the second, the electromagnetic. (See ELECTRICITY.)

Electric quantity . . .	$L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}K^{\frac{1}{2}}$ or $L^{\frac{1}{2}}M^{\frac{1}{2}}\mu^{-\frac{1}{2}}$
Electric current . . .	$L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-2}K^{\frac{1}{2}}$ or $L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}\mu^{\frac{1}{2}}$
Magnetic pole . . . . .	$L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-1}\mu^{\frac{1}{2}}$
Electric resistance . . . . .	$LT^{-1}\mu$
Electromotive force . .	$L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}K^{-\frac{1}{2}}$ or . . . . . $L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-2}\mu^{\frac{1}{2}}$
Electric capacity . . .	$LK$ . . . . . $L^{-1}T^2\mu^{-1}$

The dimensions of any one physical quantity, however expressed, must be identical; and therefore, choosing electric current

$$L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-2}K^{\frac{1}{2}} = L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}\mu^{-\frac{1}{2}} \text{ or } LT^{-1} = \mu^{-\frac{1}{2}}K^{-\frac{1}{2}}. \text{ Hence } \mu K = L^{-\frac{1}{2}}T^{\frac{1}{2}}.$$

This means that, although the dimensions of neither electrical nor magnetic inductivity are known in terms of length, mass, or time, the product of the two has the dimensions  $L^{-\frac{1}{2}}T^{\frac{1}{2}}$ , i.e., the same dimensions as the square root of the reciprocal of a velocity.

It should be noted that work and moment of force have the same dimensions; but there is a difference in this respect—in work the element of distance is in the direction of the force, while in moment of force the element of distance is at right angles to the direction of the force. This might be indicated by calling  $X$  and  $Y$  the dimensions of length in directions at right angles to each other; in which case force has the dimensions  $MXT^{-2}$ ; work,  $MX^2T^{-2}$ ; moment of force,  $MYXT^{-2}$ .

In any equation connecting physical quantities it is evident that the dimensions of the quantities on the two sides of the equation must be identical; for a mass cannot equal a length, etc. This fact is often useful either in verifying general conclusions or in . . . the connection between various . . . . . The subject of dimensions is thoroughly treated in Daniel's *Text-Book of the Principles of Physics* (London, 1894); Maxwell, *Heat* (ib., 1891); Everett, *The C. G. S. System* (ib., 1902).

**DIMETHYL KE'TONE**. See ACETONE.

**DIMIDIATION** (Lat. *dimidiatio*, a halving, from *dimidiare*, to halve, from *dimidius*, half, from *di-*, apart + *medius*, middle). In heraldry, the marshaling of arms (q.v.) followed chiefly before quartering and impaling came into use and retained to some extent in continental heraldry. It consists in cutting two coats of arms in half by a vertical line and uniting the dexter half of the one to the sinister half of the other.

**DIMIN'UEN'DO** (It., diminishing). A term in music, meaning "to diminish in loudness." Diminuendo can be applied to a single note,





reptilian or Upper Jurassic, by almost the entire period of the Jurassic period. See ORNITHOSAURIA; PTERODACTYL.

**DIMORPHOUS.** See ISOMORPHISM.

**DIMSDALE, THOMAS** (1712-1800). An English physician, . . . . .bert Dimsdale, one of the compan . . . . . Penn on his first voyage to America, in 1682. He was born at Theyden-Gernon, was educated at St. Thomas's Hospital, and practiced medicine at Hertford. His work upon inoculation, entitled *The Present Method of Inoculation for the Smallpox*, was first published in 1767 and was subsequently frequently reprinted. His fame as an inoculator for the smallpox spread rapidly, and in 1768 he was invited to St. Petersburg to inoculate the Empress Catharine and several of her family. For this service he received a sum equivalent to \$50,000 and an annuity, besides other valuable gifts. In 1784 he made another voyage to the Continent and visited the courts of St. Petersburg, Vienna, and Berlin. His medical works include: *Thoughts on General and Partial Inoculation* (1776); *Observations on the Plan of a Dispensary and General Inoculation* (1780); *Tracts on Inoculation* (1768, 1781).

**DIMYARIA.** See LAMELLIBRANCHIATA.

**DINAH.** The daughter of Jacob and Leah. According to Gen. xxiv, she was violated by Shechem, the son of Hamor, a Hivite ruler. An alliance with the sons of Jacob was proposed and accepted on condition that Shechem's people be circumcised. Before their wounds were healed, however, they were treacherously murdered by Simeon and Levi, brothers of Dinah. For this deed Jacob rebuked his sons. It is assumed by Wellhausen and many other scholars that Dinah is the eponym of an Israelitish clan whose absorption by marriage in the city population of Shechem was avenged by the kindred tribes of Simeon and Levi with a ruthlessness to which their own dissolution was afterward traced. But this view is rejected by Ed. Meyer, who deems it no more justifiable than it would be to interpret Helena as a Greek tribe in danger of being absorbed by the Trojans, and who prefers to think of her as a mythical figure. The author seems to have regarded the Hivites as uncircumcised. This, however, may be due to ignorance of the customs of an earlier population that had completely disappeared. See CIRCUMCISION.

Consult Meyer, *Die Israeliten und ihre Nachbarstämme* (1906), and Wellhausen, *Israelitische und jüdische Geschichte* (7th ed., 1914).

**DINAN, dē'nān'** (Gall., fortress on the water, from its situation on the Rance). A town in the Department of Côtes-du-Nord, France, situated on the Rance, 30 miles northwest of Rennes and 14 miles south of Saint-Malo (Map: France, N., C 4). It stands on the summit of a steep cliff of granite, with the Rance flowing through a valley 250 feet below and crossed by a fine stone viaduct 130 feet high and 810 feet long. The town is surrounded by old walls, pierced by four gates, and was defended by the castle of the Countess Anne, still in an excellent state of preservation, part of it being now used as a prison. In the older district the streets are crooked, narrow, and steep, many of the buildings being wooden constructions, though picturesque in some places. The cathedral of St. Sauveur is a beautiful building, the north side being in the Gothic, the south in the Romanesque style. In the north transept an inscription points out where the heart of Bertrand Du Gues-

clin is buried. The church of Saint-Malo contains a painting by Archenault, "Christ Triumphant over Sin." Dinan has an interesting museum. Its industries include the manufacture of agricultural implements, fine linen, sailcloth, cotton and woolen goods, beet-root sugar, and cider. It also builds barges which are used in its coasting and inland trade on the Rance. Pop., 1901, 10,534; 1911, 11,410. Dinan dates from the Roman period; the chief event in its history was the siege by the English, under the Duke of Lancaster, in 1359, when it was captured and later retaken by Du Guesclin. Consult Bazouge, *Guide du voyageur dans la ville de Dinan et ses environs* (Dinan, 1875).

**DINANT, dē'nān'** (Gall., fortress on the water, from its situation on the Meuse). A town of Belgium, in the Province of Namur, situated on the Meuse, 17 miles by rail from Namur (Map: Belgium, C 4). The most noteworthy buildings of Dinant are the church of Notre Dame, an ancient and richly decorated Gothic structure, and the city hall, once the palace of the princes of Liège. Dinant has several mills for sawing the black marble found in the vicinity, paper mills, carpet factories, breweries, tanneries, factories for the production of metal ware, and glassworks. In the Middle Ages Dinant was famous for its copper ware, or *dinanderie*. Dinant, which dates from the sixth century, has suffered greatly from frequent sieges. In 1466 Philip, Duke of Burgundy, attacked it with a strong force and drowned a large number of its inhabitants after the town was taken. In 1554 and 1675 it was taken and plundered by the French. It is now one of the most popular Belgian summer resorts. Pop., 1900, 7512; 1910, 7690. Consult Pirenne, *Histoire de la constitution de la ville Dinant au moyen âge* (Ghent, 1889), and Hachez, *Histoire de Dinant* (Cour Saint-Etienne, 1894-96).

**DINAPUR, dē'nā-poor'.** An important military station in the Patna district, Province of Behar and Arissa, British India, on the right bank of the Ganges, 10 miles west of Patna (Map: India, D 3). It contains spacious barracks. In 1857 it was the scene of the mutiny of three Sepoy regiments. It has cabinet factories, iron foundries, and oil presses. Pop., 1901, 33,699; 1911, 31,025.

**DINARCHUS** (Gk. Δειναρχος, *Deinarchos*) (c.361-291 B.C.). A Greek orator of moderate ability, born in Corinth. Going early to Athens, he studied with Demetrius Phalereus and Theophrastus and became a writer of speeches. Of these there were many, but only three are extant; these bear the titles *Against Demosthenes*, *Against Aristogeiton*, *Against Philocrates*, and were used in the prosecution of the three men named on the charge of having accepted bribes from Harpalus (q.v.). His most successful period was that of the governorship of Demetrius Phalereus (317-307), after which he retired as an exile to Chalcis, returning to Athens in 292 B.C. Dionysius of Halicarnassus (q.v.), who wrote a treatise on the life and speeches of Dinarchus, held that 58 out of 85 speeches current under his name were genuine. For his speeches, consult: Mätzner, text and commentary (Berlin, 1842); Thalheim (ib., 1887); Blass, *Attische Beredsamkeit* (Leipzig, 1887-93).

**DINARD, dē'nār',** or **DINARD-SAINT ENOGAT, sǎn'tā'nō'gǎ'.** The capital of a canton in the Department of Ille-et-Vilaine, France,

on the estuary of the Rance, opposite Saint-Malo and Saint-Servan. It is the most fashionable sea-bathing resort in Brittany and is a picturesque modern town, situated on a rocky promontory with beautiful views. It has beautiful villas and summer cottages, a fine sandy beach, well-appointed bathing establishments, a casino, an American and English colony, and is greatly frequented by foreign tourists. Saint-Enogat, an ancient village to the northwest, has a fine beach on the Bay of Saint-Malo. Pop., 1911, 7003.

**DINARIC RACE**, *dī-nār'ik* (from the Dinaric Alps). A name applied by Deniker to the dark, short-headed, tall people along or near the coast of the northern Adriatic, especially in Bosnia, Dalmatia, and Croatia; also in Roumania, Venetia, among the Slovenes, the Ladinis of the Tirol, the Romansch of Switzerland, and in parts of France. Stature, 1.68 to 1.72 meters average; cephalic index, 85-86; brown or black wavy hair, dark eyes, straight eyebrows, long faces, delicate aquiline noses, tawny skin. Consult Deniker, *Races of Man* (London, 1900), and Ripley, *Races of Europe* (New York, 1899).

**DINCKLAGE - CAMPE**, *dīnk'lā-ge-kām'pe*, AMALIE (EMMY) VON (1825-91). A German novelist. She was born on the family manor at Campe, Hanover. She traveled extensively in Europe and also visited the United States (1880). Her fine powers of observation and the poetic beauty of her descriptions, particularly of the Ems River region, in which she lived, won for her the title *Die Dichterin des Emslandes*. Her novels, tales, and romances, several of which have been translated, include: *Tolle Geschichten* (1870); *Emsland-Bilder* (1881); *Jung Alarichs Braut* (1890).

**DINDINGS**, *dīn-dīngz'*, THE. A portion of the British colony of the Straits Settlements (q.v.), consisting of the small island of Pangkor, off the west coast of the Malay Peninsula, and a portion of Perak (q.v.) (Map: Burma, D 6).

**DINDORF**, *dīn'dōrf*, KARL WILHELM (1802-83). A German classical scholar. He was born in Leipzig, studied at the University there, and early completed Invernizzi's edition of Aristophanes (vols. vii-xiii, 1820-34), and himself prepared a much smaller edition of that poet (2 vols., 1827). In 1827, too, he edited Athenæus. From 1828 to 1833 he was professor of the history of literature in the University of Leipzig. In 1833 he resigned his university post, and devoted himself to study and publication for many years, being with his brother Ludwig (q.v.) and K. B. Hase, an important contributor to the republication of Stephanus' *Thesaurus Linguae Graecae* (Paris, 1831-65). He prepared a collective arrangement of the text of all the Greek dramatists in his *Poetae Scenici Graeci* (1830; 5th ed., 1869). Later he edited them separately, with notes and scholia (Oxford, 1832-63). His *Metra Aeschylī, Sophoclis, Euripidis et Aristophanis* (1842) is a valuable study, and his lexicons to Sophocles (1870) and Aeschylus (1873-76) are useful. In 1846-51 he published at Oxford an edition of all the speeches of Demosthenes, with notes and the Greek scholia (9 vols.). For the *Corpus* of writers of the Byzantine period, of which Niebuhr was general editor, he edited several historians, among them Procopius. In 1846-51 he published a notable edition of Demosthenes (9 vols.). In 1867-71 he edited Eusebius of

Cæsarea. He is to be ranked among the leading Hellenic scholars of recent times. Consult Sandys, *A History of Classical Scholarship*, vol. iii (Cambridge, 1908).

**DINDORF**, LUDWIG AUGUST (1805-71). A German classical scholar of distinction. He was born in Leipzig and studied under Gottfried Hermann. In 1823 he began his literary activity by publishing, with full critical commentary, Xenophon's *Symposium* and *Agésilas*. From this time to his death he kept almost equal pace with his brother Wilhelm (q.v.) in editing critical texts, although he centred his attention chiefly on the historians. He published editions of *Thucydides* (1824), *Xenophon* (1853-66), *Diodorus Siculus* (last ed., 1867-68), *Pausanias* (1845), *Polybius* (1866-68), *Dio Cassius* (1863-65), *Zonaras* (1868-75), the collection of *Historici Graeci Minores* (1870-71). For the *Corpus Scriptorum Historiae Byzantinae* he edited *Johannes Malalas* (1831) and the *Chronicon Paschale* (1832). He also published editions of *Hesiod* and *Euripides* (1825), and, with his brother and K. B. Hase, prepared a revised edition of Stephanus' *Thesaurus Graecae Linguae* (Paris, 1831-65). Consult Bursian, *Geschichte der klassischen Philologie in Deutschland* (Munich, 1883), and *Allgemeine deutsche Biographie*, vol. v (Leipzig, 1877).

**D'INDY**, P. M. T. V. See INDY.

**DINDYMENE** (Lat., from Gk. Δινδυμήνη). The by-name of Cybele (q.v.), from Mount Dindymus in Phrygia, which was sacred to the goddess.

**DINEIR**, *dē-nā-ēr'*; also known as GEYIKLAR, the place of stags. The ancient Celænæ. A town in Asia Minor at an altitude of 2845 feet in the Province of Aidin. Its site lies close to the headwaters of the Mæander River. This position also commands the road from the Lycus valley to the interior. The junction of these two natural routes made of Celænæ one of the most important centres of commerce and civilization in the centuries following Alexander's death. The same causes are operating again to bring about Dineir's modern prominence. The town is the most convenient outlet for the products of the Anatolian plateau. It is at present the easternmost terminal of the Aidin Railway running from Smyrna. Plans are now (1914) considered to make it the northern terminal of the railroad built inland from Adalia. The environs of Dineir constitute a rich agricultural district. Numerous flour mills are operated in the town. The dwellings present the peculiarity of being partly constructed of blocks of marble and sculpture obtained from the ruins of the ancient town. Pop., 2000, of which 1200 are Turks.

**DINGAAN**, *dīn-gān'*. A chief of the Zulus. See ZULULAND.

**DINGELSTEDT**, *dīng'el-stēt*, FRANZ VON (1814-81). A German poet, dramatist, and novelist, born at Halsdorf, Hesse. He won popular favor, but shocked official Germany by his liberal *Lieder eines kosmopolitischen Nachtwächters* (1841). His *Gedichte* (1845) were less offensive and more poetic. His somewhat frivolous manner of dealing with serious problems is shown in his later sketches of travel, *Das Wanderbuch* (1847), and his society novel, *Die Amazone* (1868). He adapted Molière and Shakespeare to the German stage, wrote *Studien und Kopien nach Shakespeare* (1858) and a successful tragedy, *Das Haus der Barneveldt*

(1851). He won great success as a theatrical director at Munich, Weimar, and Vienna, was ennobled in 1867, and made Baron in 1876. His complete works appeared in 12 vols. in 1877. Consult his autobiography under the title of *Munchner Bilderbogen* (1879).

**DINGLE**, din'gl. A seaport, the most westerly town in Ireland, in County Kerry, 39 miles west-northwest of Killarney (Map: Ireland, A 4). It has an antique aspect, some of the houses having been built in the sixteenth century, in the Spanish style, with stone balconies, etc. The chief exports are corn and butter to Liverpool. Dingle was incorporated in 1585. Pop., 1901, 2,142; 1911, 2,219.

**DINGLE**, den'glā. A town of Panay, Philippines, in the Province of Iloilo, situated on the Jalaur River 18 miles north of Iloilo. There are gold deposits in the vicinity. Dingle was founded in 1825. Pop., 1903, 12,129.

**DINGLEY**, NELSON, JR. (1832-99). An American Republican politician and journalist. He was born in Durham, Me., graduated at Dartmouth in 1855, and in the following year became proprietor of the *Lewiston Journal*, of which he was also editor for 20 years. From 1862 to 1873 he served in the State Legislature, being Speaker in 1863 and 1864, and in 1874-75 was Governor. From 1881 until his death he was a member of Congress, where he was a specialist in tariff legislation and was the framer of the tariff law of 1897, which bears his name. In 1898 he was appointed a member of the Joint High Commission on controversies between Canada and the United States.

**DINGLINGER**, ding'ling-ēr, JOHANN MECHOR (1664-1731). A German goldsmith and jeweler. He was born at Biberach and in 1693 settled at Dresden. Here he became a favorite with Augustus the Strong, who appointed him court goldsmith, and also with Peter the Great, who twice was his guest while on a visit to Dresden. Dinglinger's only authentic works are in the Green Vaults in Dresden. They are characterized by perfection of workmanship, variety of technique, and vivid imagination; but are overloaded with ornament. Among the principal are "The Court of the Grand Mogul," a splendid table service consisting of more than 130 figures (1701-09); a chalcedony vase representing the "Bath of Diana" (1720); the so-called "Obelisk Augustalis" of enamel, gold, and precious stones; and a cabinet piece illustrating "Life's Joys." Consult the monograph by Sponzel (Stuttgart, 1904).

**DINGO**, din'gō (native Australian name). The wild dog of Australia (*Canis dingo*), remarkable not only for being the only species of dog existing both wild and domesticated, but also for being the only carnivorous placental mammal in Australia. Some writers have regarded the dingo as an example of the domestic dog run wild, but the occurrence of its remains in the Quaternary strata of Australia, and even in cavern deposits of Pleistocene time, seems to make any such position untenable, though it is not impossible that the dingo may have been brought to Australia by man when he first set foot on that continent. The improbability of Australia possessing a native placental mammal of such large size, and the fact that it is not found in Tasmania or New Zealand, lend force to the belief that it is a dog of Asiatic origin brought to Australia by the Malays, who visited the northeast coast in their proas in his-

toric ages. With the advance of civilization the dingo, like the native races to which it is a companion, has gradually disappeared from large parts of southern and eastern Australia. As it is a serious menace to flocks of sheep, the settlers have made war upon it, and its extermination as a wild animal is not improbable. Its local extermination, however, has more than once been followed by so great an increase of grass-eating marsupials, upon which it preyed, that special efforts have been necessary to kill them off in turn.

The dingo is about 2½ feet in length and somewhat less than 2 feet high. The ears are rather large and erect, and the tail is bushy. The color varies from pale brown to black, tawny shades being common. Windle says an average skull measures 302 millimeters in length and 172 millimeters in width. The dingo does not bark or growl in its wild state, but utters wolfish howls, especially at night. Tame dingoes, placed among other dogs, however, soon learn to bark. They are great hunters, pursuing their prey in packs and running with the head carried high and the ears erect. They kill more than they can possibly use, are cunning and courageous, and themselves afford good sport for a pack of hounds.

The dingo is domesticated by the native Australians in all parts of the continent, the puppies being found in hollow trees and similar places where the female "nake their lairs. They are not only faithful companions, but are of the greatest use to the natives, by assisting them in finding opossums, rats, snakes, and lizards for food. Nevertheless the black fellows hunt, kill, and eat the wild dingoes. A dingo's blood has been used to make the "celpie, the most prized of all cattle dogs. They are trained never to bark. Consult Smyth, *The Aborigines of Victoria* (Melbourne, 1878), and *Wild Bush Wanderings* (London, 1865). See DOG, and Plate of WOLVES AND WILD DOGS.

**DINGRAS**, dën-gräs'. A town of Luzon, Philippines, on the Grande de Laoag River in the Province of Ilocos Norte, 10 miles southeast of Laoag. It is situated in a fertile plain, surrounded by mountains, which is subject to inundations. Dingras was founded in 1598. Pop., 1903, 15,792.

**DINGWALL**. A royal burgh, the county town of the united counties of Ross and Cromarty, Scotland, at the head of the Cromarty Firth, 18½ miles northwest of Inverness (Map: Scotland, D 2). It lies low, amid rich, fertile, and well-wooded ground, at the entrance to the beautiful valley of Strathpeffer, the famous sulphurous springs of which are 5 miles to the west. A short canal brings vessels drawing 9 feet of water up to the town. Its prosperity depends on agriculture. Pop., 1901, 2519; 1911, 2639. To the west is a vitrified fort on a conical hill, and there are traces of an ancient castle where the earls of Ross held their courts.

**DIN'IA**. See DIGNE.

**DIN'IAS** (Lat., from Gk. Δεινίας, *Deinias*) and **DERCYLLIS** (Lat., from Gk. Δερκυλλίς, *Derkyllis*). Characters in an old Greek novel, in 24 books, now lost, entitled *Incredible Things in Thule*, by Diogenes Antonius, a Syrian of the second century B.C. The work served as a source for various later authors.

**DINICHTHYS**, di-nik'this (Neo-Lat., from

Gk. *δεινός*, *deinos*, terrible + *ἰχθύς*, *ichthys*, fish). A genus of fossil dipnoan fishes of large size belonging in the order Arthrodira, and found in the uppermost Devonian and Lower Carboniferous rocks of North America, and less commonly in Europe. The body is estimated to have had a length of 15 to 18 feet, but few traces of other portions than the heavy armor plates of the head and anterior part of the trunk have been observed. The general form is similar to that of *Coccosteus*, with which it is quite closely related. The head was often over 3 feet in width and 4 or more feet long, and the bones of the skull were heavy plates, well joined together to form a solid dorsal head shield. The eyes were of large size, as indicated by the form of the orbital notches in the margin of the head shield. The dentition, which resembles that of the modern *Protopterus*, was very formidable. It consisted, in the upper jaw, of two large anterior triangular teeth that functioned as incisors, and two lateral oblong plates with sharp enameled cutting edges. The lower jaws are very strong and have at their anterior ends prominent sharp teeth that interlock with those of the upper jaw, and behind these the upper edges of the jaws are hardened by enamel and sharpened to form very efficient smooth or denticulate cutting edges, that must have engaged with the sharp edges of the upper jaw in mastication. The plates of the ventral surface of the head and those of the anterior part of the trunk resemble the corresponding plates in the genus *Coccosteus*, and there is a hinge joint between the head plates and the body plates.

The larger number of these fossils have been found in the Upper Devonian Cleveland shale of Ohio, from which formation they were originally described by Prof. J. S. Newberry. The best-known species are *Dinichthys hertzeri* and *Dinichthys terrelli*. Consult: Newberry, "The Palaeozoic Fishes of North America," in *Monograph of the United States Geological Survey*, vol. xvi (1890); Dean, *Fishes, Living and Extinct* (New York, 1895); Dean, "Contributions to the Anatomy of Ichthyosaurs," etc., in *Transactions of the New York Academy of Sciences*, vol. xv (1896); vol. xii (1894) and vol. xvi (1898); id., "Studies on Fossil Fishes," in *Memoirs of the American Museum of Natural History*, vol. ix (New York, 1909). See LUNGFISH.

**DINIZ DA CRUZ E SILVA**, *dé-nêz' dâ krôoz é sêl'vâ*, ANTONIO (1731-99). A Portuguese heroico-satirico-comic poet, born in Lisbon. He is considered one of the revivers of the poetry of Portugal (for he helped found the *Arcadia Lusitana*), and has been called the "Portuguese Pindar." His works are full of local color, and his odes are fine, but his admiration for the classics of antiquity was such that instead of drawing from them his inspiration he contented himself too often with mere imitation. His best work, *O Hyssope* (1802, and frequently since), is not open to this criticism. Diniz was a keen observer, and in this work, to which he owes his immortality, he pictures faithfully and ruthlessly the vanities, intrigues, and blind ignorance of the society of an important provincial town dominated by two antagonistic cliques—one supporting the commandant of the garrison and the other the Bishop of the diocese. The work was translated into French prose by Boissonade and has gone

through two editions (Paris, 1828, 1867). Selections have appeared in English in the *Foreign Quarterly Review* and in the *Manchester Quarterly* (1896). The best edition of *O Hyssope* is that by J. R. Coelho (Lisbon, 1879), with introductory study of the poet and his works. His collected works are entitled *Poesias* (6 vols., Lisbon, 1807-17).

**DINIZULU**. See ZULULAND.

**DIN'KA** (native name *Jyeng*). The largest negro tribe of the Egyptian Sudan, living on both sides of the White Nile between lat. 12° and 6° N. Their country covers about 40,000 square miles. They are a tall race, intensely black, and they live chiefly from their numerous herds of cattle. Polygamy is practiced. The men wear practically no clothes and both sexes extract the two lower incisor teeth. Being brave warriors, they furnish the best material for the Sudanese regiments. The most complete grammar of their language is that of Mitterutzner (Brixen, 1866). On their manners and customs, consult: Schweinfurth, *In the Heart of Africa*, trans. by Frewer (London, 1873); Kaufmann, *Schilderungen aus Central Afrika* (Brixen, 1862); Count Gleichen, *The Anglo-Egyptian Soudan* (London, 1905).

**DINKARD**, *dên-kîrd'* (Pahlavi *Dinkart*, acts of religion). A collection of facts concerning the Zoroastrian religion, compiled shortly after the Mohammedan conquest of Persia. It has been edited, with English and Gujerati translation, by Peshotan Behramji Sanjana, vols. i-xiii (Bombay, 1874-1912).

**DINKEY**, ALVA CLYMER. An American business man, born at Weatherly, Pa. After receiving a public-school education he became connected with the Carnegie steel interests in Pennsylvania, being promoted through various positions to be general superintendent of the Homestead Steel Works in 1901. In 1903 he became president of the Carnegie Steel Company.

**DIN'MONT**, DANDIE. An eccentric border farmer in Scott's *Guy Mannerling*.

**DINOCERAS**, *dî-nô's'ér-as*. See TINOCERAS.

**DINO COMPAGNI**, *dê-nô kôm-pâ'nyé*. See COMPAGNI, DINO.

**DINOC'RATES** (Lat., from Gk. *δεινοκράτης*, *Deinokratēs*). A Greek architect, who, according to Vitruvius (ii, 1-4), visited the camp of Alexander the Great with letters of introduction, but was unable to secure an audience. Relying upon his athletic figure, he at length decked himself in the costume of Heracles, with lion's skin and club, and thus attracted the notice of the King. He then proposed to Alexander to carve the huge mass of Mount Athos into a seated human figure, holding a city in one hand and a vessel of water in the other, into which all the rivers of the mountain should flow. The work was never attempted, but Dinocrates was taken into the favor of the King and employed as architect in the foundation of Alexandria. He was also employed by the Ephesians in the reconstruction of the temple of Diana (see DIANA, TEMPLE OF). He constructed also the funeral pyre of Hephaestion.

**DINOR'NIS** (Neo-Lat., from Gk. *δεινός*, *deinos*, terrible + *ὄρνις*, *ornis*, bird). A genus of gigantic, recently extinct, ratite birds, the typical moas, taken as the type of the family Dinornithidae. See MOA, DINORNIS ANIMALS.

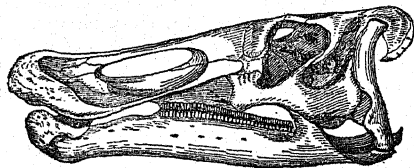
**DINOSAURIA** (Neo-Lat., from Gk. *δεινός*,

*deinos*, terrible + *σαῦρος*, *sauros*, lizard). An order of fossil reptiles, found only in rocks of Mesozoic age, and containing some of the most wonderful and bizarre land animals that have ever lived. In general, the dinosaurs present the same reptilian characters as do the crocodilians and pterosaurians, which have been derived from the same original stock, and within the order the form is so variable that it is difficult to find reliable distinctive characters. The more primitive genera can scarcely be distinguished from the generalized crocodiles, others resemble the rhynchocephalians, others the pterosaurians, and still others are far removed by specialization along particular lines and afford most remarkable and extravagant forms. The closest living allies of the dinosaurs are the crocodiles and the ratite birds (ostrich, etc.), which, with the more primitive dinosaurs, were probably descended from a common ancestral stock in Triassic times, such as the Pseudo-suchians.

TOOTH OF DI-  
PLODOCUS.

Section of maxillary bone of *Diplodocus longus*, showing functional tooth (fourth) in position and five successional teeth (2, 3, 4, 5, 6) in dental cavity; a, outer wall; b, inner wall; c, c, cavity; f, foramen.

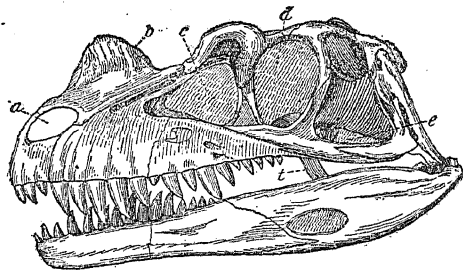
of birdlike structure, often with anterior and posterior elongation of the elements. The limbs are fitted for locomotion on land; the forward pair is often reduced in size so that locomotion is bipedal. Reduction of the number of toes on the hind feet to three is common. In some gigantic genera the tail was unusually strong and with the hind limbs formed a tripod support for the animal, which was thus enabled to raise its head to a height sometimes of 30 feet above the ground and to overlook the vegetation of the marshes in which it wallowed. The dentition of dinosaurs is fitted for both carnivorous and herbivorous food. Beaklike structure of the jaws is common. The teeth are often implanted in sockets, and in some genera they appear in successional series. The head of dinosaurs is usually disproportionately small, and the brain is always of very small size and low degree of convolution, indicating



SKULL OF CLAOSAURUS ANNECTENS.

an inferior grade of intelligence in these animals. In some forms with small head, long neck, heavy body and hind quarters, and long heavy tail, where the hinder part of the body overbalances by far the forward portion, as in

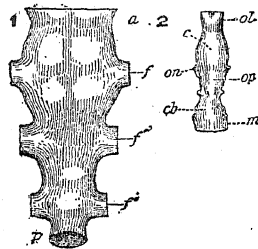
*Brontosaurus*, *Diplodocus*, *Scelidosaurus*, and *Stegosaurus*, the neural ganglion in the sacrum is many times larger than the cephalic ganglion



SKULL OF CERATOSAURUS.

or brain, a condition necessitated by the great mass of the body that must be innervated from the sacral ganglion in these animals.

In habits the dinosaurs were terrestrial and often amphibious, and the structure of the tail in some genera indicates its use as a swimming organ. Some were of graceful, birdlike action, walking, running, or leaping on their three-toed hind limbs. Others were heavy, clumsy beasts, walking or crawling on their solidly built four legs. Dinosaurs vary greatly in size. The smallest are of the size of a chicken. The largest are the greatest land animals ever known to have existed, with lengths of 60 to 70 feet,



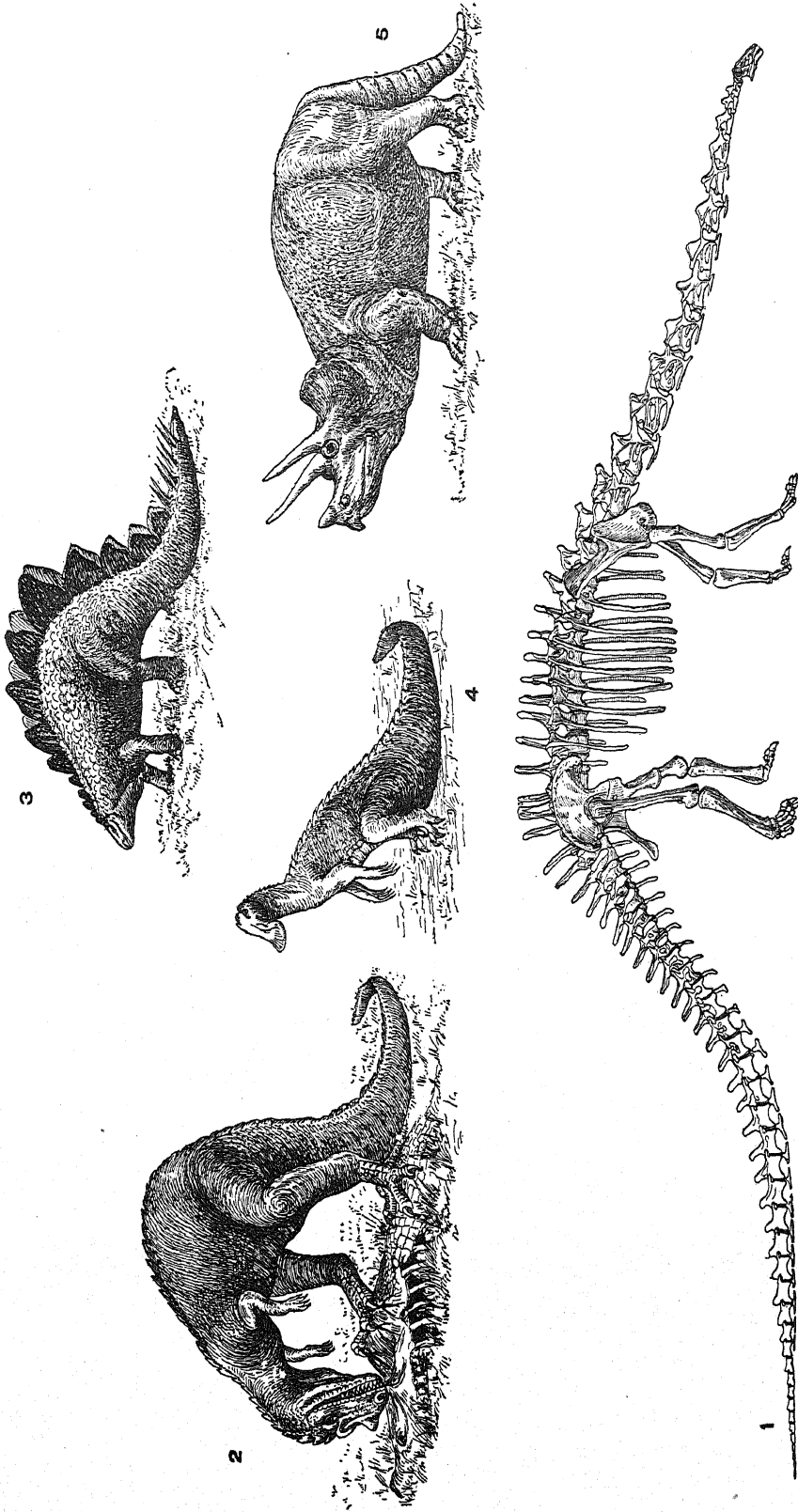
CEPHALIC AND SACRAL GANGLIA.

Drawings of casts showing the expansions of the spinal cord of *Stegosaurus ungulatus*. 1. Cast of neural cavity of sacrum; a, anterior end; p, posterior end at exit of neural canal in last sacral vertebra; f, f', f'', foramina between the sacral vertebrae. 2. Cast of brain cavity of same animal; c, cerebral hemispheres; cb, cerebellum; m, medulla; ol, olfactory lobes; on, optic nerve; op, optic lobes.

heights of 10 to 20 feet, and weights estimated to have varied from 20 to 25 tons. Dinosaurs appeared in the early Triassic time, and during the Jurassic and Cretaceous periods they ruled the land, but towards the end of the Cretaceous they began to decline, and they finally gave way to the early mammals. The remains of the latest members of the order are found in the uppermost formations of the Cretaceous, viz., the Laramie group of western America. Their remains have been found in the Mesozoic rocks of Europe, southern Asia, South Africa, North Australia, North and South America, and the most noted localities whence they have been obtained are those of Bernissart in Belgium, and the Rocky Mountain region of North America. The order Dinosauria is divided into three suborders, some of the peculiarities of which are here given. They are the Sauropoda, Theropoda, and Predentata.

**Sauropoda.** This group resembled the crocodiles and rhynchocephalians in the structure of its skeleton and the proportions of its parts. It includes the gigantic herbivorous genera: *Atlantosaurus*, *Cetiosaurus*, *Brontosaurus* (q.v.), and *Diplodocus* (q.v.), with very small head, long neck, heavy trunk supported on strong planti-

# DINOSAURS



1. SKELETON OF DIPLODOCUS (Order Sauropoda).
2. CERATOSAURUS (Order Theropoda).
3. STEGOSAURUS (Order Ornithomimidae).
4. HADROSAURUS (Suborder Ornithomimidae).
5. TRICERATOPS (Order Ceratopsia).



grade five-toed fore and hind limbs of equal size, and with a heavy long tail. The teeth are long, spatulate, and spreading. The bones are solid and heavy, and the pubis is simple. This group is of Upper Jurassic and Lower Cretaceous age.

**Theropoda.** Carnivorous dinosaurs with cutting teeth in sockets. Their skeletons are of rather delicate construction, and their vertebræ and limb bones are hollow. Their five-toed fore limbs are of small size and apparently of little use as locomotory organs, but their three-toed hind limbs are strong, and the toes are furnished with prehensile claws. These dinosaurs were digitigrade, and they walked as do birds or leaped as do the kangaroos. The pelvic bones are elongated. Examples of this suborder are *Anchisaurus*, *Ceratops*, *Tyrannosaurus*, and *Megalosaurus* (q.v.). *Hallopus*, a leaping dinosaur from the Jurassic of Colorado, and the birdlike *Compsognathus*, one of the smallest dinosaurs, from the Jurassic lithographic limestones of Solenhofen, Bavaria, also belong in this division.

**Predentata.** Here are included the most specialized and hence the most extravagantly formed of dinosaurs. They were all herbivorous animals that walked on either four or two feet. Some of them undoubtedly ran with great rapidity on their hind legs, using the tail as a balance after the manner of certain modern lizards. In all of them the pelvis is provided with a postpubic process, a character found in no other reptiles, and the ilium and ischium are elongated and variously modified. Another distinctive character is the presence of a pre-dentary bone on the anterior end of the mandible which has a beaklike tip. Accordingly the teeth are absent from the front of the jaws and are restricted to the posterior portions. The teeth are compressed, have crenulated edges, and they are frequently replaced by successional teeth. The Predentata comprise three divergent lines of descent—Stegosauria, Ceratopsia, Ornithopoda.

In form the Stegosaurian dinosaurs resemble most closely the Sauropoda. Their vertebræ are all biconcave, their heads are very small, and the hinder parts of their bodies are enormously developed. Many of them were armored. *Omosaurus*, from the Upper Jurassic of England, has strong dorsal spines; *Polacanthus*, of the English Wealden, has the lumbar sacral region inclosed in solid armor plate; *Scelidosaurus*, of the English Lower Lias, has a row of small vertical plates along the dorsal line. The extreme of ornamental armor is seen in *Stegosaurus* (q.v.) from the Upper Jurassic of Colorado and Wyoming, which has a row of heavy, large triangular bony plates extending from the back of the head along the back to the tip of the tail.

**Ceratopsia.** This group includes the horned dinosaurs, land reptiles of gigantic size and formidable appearance, which were evolved in late Mesozoic time after the dinosaur race had begun to decline. They are probably highly specialized descendants from the Stegosaurian race. Their remains have been found in the Upper Cretaceous rocks of Europe, but the best material has come from the Laramie group of Wyoming and Colorado. The prominent feature of these animals is the large size of the head. In *Triceratops* (q.v.), which attained a length of 25 feet, the head has a length of 6 feet, and

it is provided with three formidable horns and with a broad posterior expansion or crest, formed from the parietal bones, that projects some distance over the neck. The jaws have strong beaks in front and two-rooted teeth in their posterior portions. The skeletons of these dinosaurs are heavily built, the bones are solid, the five-toed fore limbs and the three or four-toed hind limbs are about equal in size, the feet were digitigrade, and the toes were hoofed like those of a rhinoceros. The body was protected by a thick hide, sometimes armored with bony plates, and the tail was smaller than in any other dinosaurs. The best-known genera are *Agathaumas*, *Triceratops* (q.v.), and *Sterrhopholophus*.

**Ornithopoda.** These are the most bird-like of the dinosaurs, with small five-toed fore limbs and well-developed three-toed hind limbs. All the limb bones are hollow. They were unarmored, herbivorous animals, with bipedal walking, running, or leaping motion. *Iguanodon* (q.v.), of the Belgian Jurassic, with a length of 20 feet, is perhaps the best-known genus. *Claosaurus* or *Thespesius* (q.v.), from the North American Cretaceous rocks, attained a length of 35 feet. *Hadrosaurus* (q.v.), from the Laramie group, had a spoonbill beak, like that of *Ornithorhynchus*. Here, also, belongs *Nanosaurus*, the smallest-known dinosaur, which was scarcely as large as a domestic fowl, found in the Upper Jurassic rocks of Colorado.

Fossil remains of dinosaurs are to be seen only in the larger museums of the country. The American Museum of Natural History in New York City has the finest series of skeletons, many of which are accompanied by water-color restorations of these animals. Other museums where dinosaurs may be seen are the United States National Museum at Washington, Peabody Museum of Yale University, Carnegie Museum at Pittsburgh, where a complete skeleton of *Diplodocus* is mounted, the Field Columbian Museum at Chicago, and the museum of the University of Wyoming at Laramie.

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ern," *Zoolog. Jahrbücher* (Jena, 1910); Abel, "Die Vorfahren der Vögel und ihre Lebensweise," *Verhandl. der K. K. zool.-botan. Ges.* (Vienna, 1911); Jaepel, "Die Stellung der Palaeontologie zu den Nachbarwissenschaften," *Palae. Zeitsch.* (Berlin, 1913). See also ANCHISAURUS; BRONTOSAURUS; CERATOSAURUS; DIPLODOCUS; HADROSAURUS; MEGALOSAURUS; STEGOSAURUS; THESPESUS; TRICERATOPS; TYRANNOSAURUS

**DINOTHERIUM** (Neo-Lat., from Gk. *δεινός*, *demos*, terrible + *θηρίον*, *thērion*, beast, diminutive of *θήρ*, *thēr*, wild beast). A genus of fossil proboscideans, indirectly allied to the modern elephant and the extinct mastodon, of which remains have been found in the Miocene and Pliocene rocks of Europe. The old proboscidean stem early became divided into two main branches, one of which includes the mastodon and modern elephants, and the other, the present animals. The dinotheres entered Europe with the mastodons in the Lower Miocene, continued with but little change into the Pliocene, and then died out. The skull, which is essentially elephantine, is longer, lower, and tapers more in front than does that of the modern elephant. The structure of the nasal bones and of the front of the cranium indicates that the animal had a proboscis, which was not, however, so prominent an organ of prehension as is that of the elephant. The molar teeth resemble those of the mastodon in structure, though they are smaller and have fewer transverse ridges on the crowns. The upper incisors, which attain to such great developments of tusks in the mastodon and elephant, are absent in the dinotherium, but the lower incisors, together with the fused ends of the mandibles, are turned downward and backward to form a pair of strong tusks, comparable with, though not at all analogous to, those of the walrus. The bones which have been found associated with these dinotherium skulls, and which probably belong to individuals of the same genus, are of massive build like those of other proboscidea, and indicate that the dinotherium lived under semiaquatic conditions, somewhat like the hippopotamuses. This perhaps accounts for the reason of their migration to America, the land bridges being doubtless passable only by terrestrial animals. The largest species of dinotherium lived in Pliocene time and rivaled in size the mastodon and mammoth. The skulls of this genus are found quite abundantly in the Miocene deposits of central Europe, in the Lower Pliocene of India and the Upper Pliocene of Greece, and are often associated with remains of the rhinoceros. No dinotherium remains have yet been found in America. See MAMMOTH; MASTODON.

**DINSMORE, CHARLES ALLEN** (1860- ). An American clergyman and Dante scholar, born in New York City. He served with the United States engineers in the survey of the Mississippi River (1881-82), graduated from Dartmouth College in 1884, and studied theology at Yale University. Ordained to the Congregational ministry in 1888, he was pastor of churches in Whitneyville and Willimantic, Conn., and of Phillips Church, Boston. In 1905 he accepted a call to the First Church of Waterbury, Conn. He lectured at Yale Divinity School (1904) and at Bowdoin College (1908) and wrote: *The Teachings of Dante* (1901); *Aids to the Study of Dante* (1903), both of which have been translated into Japanese;

*Atonement in Literature and Life* (1906); *The New Light on Old Truth* (1912).

**DINTER, dīn'tēr**, CHRISTIAN FRIEDRICH (1760-1831). A German pedagogue and author, born at Bornä, near Leipzig. He studied theology and pedagogy at Leipzig, held several pastorates, was appointed director of the Teachers' Seminary at Dresden-Friedrichstadt in 1797, and became professor of pedagogy and theology at the University of Königsberg in 1822. He was liberal in his religious views and practical in his methods of education. His lectures and writings by remarkable clearness of as one of the most active and influential pedagogues of the period of rationalism. He produced more than 60 distinct works. They include: *Die vorzüglichsten Regeln der Katechetik* (1802; 13th ed., 1862); *Makuna, ein Buch für Mutter* (1818; 5th ed., 1860); *Unterredungen über die Hauptstücke des lutheranischen Katechismus* (1806-23; frequently reprinted). Consult Amelung, *Dintess Grundsätze der Erziehung und des Unterrichts* (Plauen, 1881), and Fröhlich, in Gressler's *Klassiker der Pädagogik*, vol. xxi (Langensalza, 1901).

**DIN'WIDDIE, EDWIN COURTLAND** (1867- ). An American temperance advocate, born in Springfield, Ohio. He was educated at Wittenberg and Grove City (Pa.) colleges and was ordained to the Evangelical Lutheran ministry. He was State superintendent of the Pennsylvania Anti-Saloon League from 1897 to 1899 and national legislative superintendent of the American Anti-Saloon League from then until 1907 and again after 1911. He led the attack on the army canteen which resulted in its abolishment, was responsible for the continuance of prohibition in Indian Territory and Oklahoma, and helped to effect important changes in the law relating to interstate shipments of liquor. In 1909 he was chosen vice president of the World's Prohibition Confederation at London, England. His writings include many pamphlets and magazine articles.

**DINWIDDIE, ROBERT** (c.1693-1770). A Colonial Governor of Virginia. He was born in Scotland, was for some time a clerk in the customs service, was appointed surveyor of customs for the Colonies, and in 1752 came to Virginia as Lieutenant Governor. He immediately busied himself with plans for the French and Indian War, then impending, and in 1753 sent Washington to demand the withdrawal of French traders and soldiers, who had established themselves on land claimed by Virginia. He was especially active in urging the coöperation of the Colonies against the French in the Ohio valley. In 1755 he helped the expedition sent to Forts Duquesne, Niagara, Frontenac, and Point. He was in continual conflict with the Colonial Legislature, which persistently refused to vote adequate funds for carrying on the war, and in consequence he advocated the imposition of an arbitrary poll tax by Parliament. This, combined with his arrogance, his avarice, and his indecision, made him unpopular, and led to his recall in 1758. Of value for this period are *The Official Records of Robert Dinwiddie, Lieutenant-Governor of Virginia, 1751-1758* (2 vols., Richmond, 1883-84).

**DIO CASSIUS COCCELIANUS** (Gk. *Δίων Κάσσιος Κοκκεῖανός*, *Dion Kassios Kokkeianos*) (c.150-235). A celebrated Greek historian, grandson on his mother's side of Dio Chrysosto-

mus (q.v.). He was born at Nicæa, in Bithynia, but lived at Rome after 180. He held various high offices of state under the Roman emperors, was twice consul, and long enjoyed the intimate friendship of the Emperor Alexander Severus. From 229 to his death he lived at Nicæa. He is best known by his *History of Rome*, in 80 books, from the arrival of Æneas in Italy to 229 A.D.; of these 25 (36–60, covering the years 68 B.C. to 47 A.D.) have reached us fairly complete. The others are known to us only from fragments and the abridgment made by Xiphilinus, a Byzantine monk, in the eleventh century, of books 35–80. From Zonaras (q.v.) we get knowledge of the first 20 books of Dio's history. Dio's high position gave him free access to the national archives, and so on some points—especially on the Imperial epoch of Roman history—his work is of considerable value. He wrote on the model of Thucydides, to whom, indeed, he is far inferior both in vigor of judgment and acuteness of criticism; yet many passages of his *History* might be quoted as among the best samples of the rhetoric of the age in which he lived. The *History* was edited by Boissavain (3 vols., Berlin, 1895–1901). For a translation, consult *Dio's Rome: English Form*, by Foster (Troy, 1905 ff.), and Cary, *Dio's Roman History*, a translation based on Foster's version (London, 1914– ). Both translations contain biographical and bibliographical material.

**DIOCESE** (OF. *diocise*, *diocese*, Fr. *diocèse*, Lat. *diocesis*, from Gk. *διοίκησις*, *diōikēsis*, administration, from *διοικεῖν*, *diōikein*, to keep house, from *διά*, *dia*, through + *οἰκεῖν*, *oikein*, to inhabit, from *οἶκος*, *oikos*, house, Lat. *vicius*, village, Skt. *viś*, house). In the Roman Catholic and Anglican churches, a district committed to the pastoral care of a bishop. The term was used in the civil administration of the later Roman Empire, which Constantine divided into 13 districts called dioceses and these again into 120 provinces. When the church had perfected her episcopal organization and received the recognition of the state, she modeled her territorial divisions on those of the civil administration. This adaptation appears to have been completed by the end of the fourth century. There developed an exarch or patriarch in each of the great dioceses, and a metropolitan or primate in each province, the word *παροικία*, or "parish," being applied to what we now call a diocese. At a later period the word "diocese" was transferred to the territory of a bishop's jurisdiction, and the word "patriarchate" used for the ancient diocese. In the Eastern churches the civil term "eparchy" is used to this day for a diocese. At the present time dioceses of the Catholic church are erected by the Pope in consistory. Before the erection of a diocese administrative districts not formally so constituted are styled "prefectures apostolic" and "vicariates apostolic." Dioceses are created in the Church of England by act of Parliament. In the American Episcopal church new dioceses are created by primary conventions of the clergy and laity of the district and are then admitted into union with the general convention by vote of that body. See BISHOP.

**DIO CHRYSOSTOMUS** (Lat., from Gk. *χρυσόστομος*, *chrysostomos*, golden-mouthed, from *χρυσός*, *chrysos*, gold + *στόμα*, *stoma*, mouth) (c.40–115). An eminent Greek sophist and rhetorician. He was born at Prusa, in Bithynia. His father, Pasierates, paid great attention to

his education, which was also enriched by travel. Dio, after residing for some time in his native town, came to Rome, where, however, he had the misfortune to excite the suspicion of the Emperor Domitian and was in consequence obliged to flee from Italy. On the accession of Cocceius Nerva (96 A.D.) he returned to Rome and was honorably received; in gratitude he assumed the cognomen (q.v.) Cocceianus. Nerva's successor, Trajan, held Dio in the highest estimation. His excellent disposition procured him many friends, while his remarkable powers of oratory excited universal admiration. He died at Rome. Dio left a very great number of orations, of which we still have 80 complete, with 15 others. They discuss questions of politics, morals, and philosophy, and are written in good Attic Greek. According to Niebuhr, he was "the first writer after Tiberius that greatly contributed towards the revival of Greek literature." Good editions of Dio's orations are those of Reiske (Leipzig, 1784), Emperius (Brunswick, 1844), Dindorf (Leipzig, 1857), and Von Arnim (Berlin, 1893–96). Consult Sandys, *A History of Classical Scholarship*, vol. i (2d ed., Cambridge, 1906), and Christ-Schmid, *Geschichte der griechischen Literatur*, vol. ii (5th ed., Munich, 1913).

**DIOCLES**, *δι'ό-κλῆζ*. See CISSOM.

**DIO'CLE** (Lat., from Gk. *Διοκλῆς*, *Dioklēs*). A Syracusan statesman, noted for his code of laws (412–411 B.C.). He was a democratic leader, and his code, which continued in force until the Roman Conquest, in revisions by Timoleon and Hiero, tended to popular sovereignty. His failure to bury the dead, after his vain attempt to raise the siege of Himera, beset by the Carthaginians, resulted in his banishment in 408 B.C.

**DIOCLETIAN**, *δι'ό-κλῆ'shan* (GAIVS AURELIUS VALERIUS DIOCLETIANVS). A Roman emperor (284–305 A.D.). He was born of humble parents in Dalmatia (245). He adopted a military career and served with distinction under Aurelian and Probus, accompanied Carus on his Persian campaign, and finally, when the murder of Numerianus was discovered at Chalcedon, he was proclaimed Emperor in 284 by the army on its homeward march. The suspected assassin of Numerianus, the prefect Arrius Aper, he slew with his own hands, in order, it is alleged, to fulfill a prophecy communicated to him, while still a lad, by a Druidess of Gaul, that he should accede to a throne as soon as he had killed an *aper* (wild boar). In 285 Diocletian commenced hostilities against Carinus (the joint Emperor along with the deceased Numerianus), who, although victorious in the decisive battle that ensued, was murdered by his own officers, thus leaving to Diocletian the undisputed supremacy. His first years of government were so molested by the incursions of barbarians from Gaul and Germany that, in order to repel their growing aggressiveness, he took to himself a colleague—viz., Maximian—who under the title of Augustus became joint Emperor in 286. Diocletian reserved for himself charge of the eastern half of the Empire and gave the western to Maximian. Still the attacks of the barbarians continued as formidable as ever. The Empire was menaced by the Persians in the east, by the Germans and other barbarians in the west; hence, in order to provide for its permanent security, Diocletian subjected it to a still further division. In 292 Constantius Chlorus and Ga-

lerius were proclaimed as Cæsars, and the distribution of the Roman Empire was now fourfold—Diocletian taking the east, with Nicomedia as his seat of government. Maximian, Italy and Africa, with Milan as his residence; Constantius, Britain, Gaul, and Spain, with Treves as his headquarters; Galerius, Illyricum, and the entire valley of the Danube, with Sirmium as his Imperial abode. It was upon his colleagues that most of the burden of engaging actively in hostilities fell, as Diocletian seldom took the field in person. Among the conquests, or rather reconquests, that were made under his rule, may be enumerated that of Britain, which, after maintaining independence under Carausius and Allectus, was, in 296, restored to the Empire; that of the Persians, who were defeated and compelled to capitulate in 298; and that of the Marcomanni and others of the northern barbarians, who were driven beyond the Roman frontier. Diocletian, after 21 years' harassing tenure of government, desired to pass his remaining days in tranquillity. On May 1, 305, accordingly, he abdicated the Imperial throne at Nicomedia and compelled his colleague Maximian (much against the latter's will) to do likewise at Milan. Diocletian sought retirement in his native province of Dalmatia, and for eight years resided at Salona (now Spalato), devoting himself to philosophic reflection, to rural recreation, and to horticultural pursuits. Two years before his abdication he was instigated by his colleague Galerius to that determined and sanguinary persecution of the Christians for which his reign is chiefly memorable. He died in 313. Diocletian ruled as absolute monarch, but he was an able administrator. He reformed the coinage, sought to stimulate trade, and tried also to regulate the price of provisions and many other necessities of life. For the edict by which he sought to fix prices, consult Abbott, *The Common People of Ancient Rome* (New York, 1911). He adorned Rome with fine buildings; for one of these, see DIOCLETIAN, BATHS OF. Consult: Mason, *The Persecution of Diocletianus* (London, 1876); Preuss, *Kaiser Diocletian und seiner Zeit* (Leipzig, 1869); Allard, *La persécution de Dioclétien* (1890).

**DIOCLETIAN, BATHS OF.** Baths at Rome, the largest in the city, built by Diocletian and Maximian, opened in 308 A.D. and still used at the time of Theodoric. The ruins were converted into a Carthusian monastery, and the tepidarium (see BATH) into the church of Santa Maria degli Angeli, by Michelangelo; a circular hall at the southwest corner of the outer wall was made into the church of San Bernardo in 1594. The cloisters of the monastery are now used as a museum, the Museo delle Terme. For an account of the baths, with plan, consult Platner, *The Topography and Monuments of Ancient Rome* (2d ed., Boston, 1911).

**DIOCLETIAN, EDICT OF.** See DIOCLETIAN (end).

**DIODATI**, δῆ-δ'ῆ-τῆ, GIOVANNI (1576-1649). A Swiss Reformed theologian. He was born at Geneva, of a noble Italian family which, having accepted the Reformation, was driven from home by persecution. His progress in letters was so rapid that Beza caused him to be appointed professor of Hebrew in Geneva at the age of 21. He became a pastor of the Reformed church there and in 1609 professor of theology. About

this time he endeavored to spread the doctrines of the Reformation in Venice and other cities of Italy, but without success. In 1614 he went to Nîmes, where he preached for three years, and in 1618 he was sent to the Synod of Dort, to represent the Genevese church. Here his talents were so highly estimated that he was one of the divines appointed to draw up the articles of the synod. He died at Geneva in 1649. Diodati was a somewhat intolerant Calvinist, but as a preacher he was eloquent, persuasive, and conscientious. His Italian translation of the Bible—the one still generally used among the Italian Protestants—appeared in 1607; his French, in 1644. He translated into French Sarpi's *History of the Council of Trent*. Among his other works may be mentioned his *Annotaciones in Biblia* (1607); *De Fictitio Pontificiorum Purgatorio* (1619); *De Iusta Secessione Reformatorum ab Ecclesia Romana* (1628). For his life, consult Eugène de Bude (Geneva, 1869).

**DIO'DORUS** (Lat., from Gk. Διόδωρος), sur-named SICULUS. A Greek historian, born at Agyrium, in Sicily. He flourished in the times of Cæsar and Augustus—the latest date to which he refers is 21 B.C.—traveled in Asia and Europe, and lived a long time in Rome, collecting the materials of his great work, the compilation of which, he says, occupied 30 years. This work, the *Historical Library* (Βιβλιοθήκη Ἱστορικὴ, *Bibliotheca Historica*), was a universal history, in 40 books, from the beginning to 60-59 B.C. It was divided by the author into three parts. The first six books contain an account of the mythical history of all known nations down to the time of the Trojan War; the second part (books 7 to 17) covers the period from the Trojan War to the death of Alexander; the third (books 18 to 40) extended to Cæsar's Gallic wars. Books 1 to 5 are extant; so too are Books 11 to 20, containing the history from the expedition of Xerxes to the war against Antigonus; of books 21 to 40 we have only scanty extracts and quotations by other writers, e.g., Photius (q.v.). Diodorus took Ephorus for his model and set to work on his history with excellent purpose; but the annalistic arrangement of his work in itself was wholly unfitted for so comprehensive a history. Furthermore, Diodorus had no experience in practical life and military training, so that he lacked the insight necessary to carry out his undertaking; his style is monotonous and wearisome, and he was almost wholly without critical historical judgment. Yet his work is valuable for its contents, especially since the authors from which it was compiled have been lost. The best edition is by Dindorf, revised and provided with critical apparatus by Vogel (Leipzig, 1888-93), and by Fischer (1905-06). Consult Bröcker, *Untersuchungen über Diodor* (1879), and Von Mess, in *Rheinisches Museum*, 61 (1906).

**DIECIOUS PLANTS.** See DIECISM.

**DIE'CISM** (from Gk. δι-, δι-, double + *oikos*, *oikos*, house). Primarily this word applies to that condition in plants in which the male and female organs are borne by different individuals. In its original application, however, it referred to the fact that in some seed plants the stamens and pistils are borne by separate individuals. Diecism in mosses and ferns, therefore, does not mean the same thing as diecism in seed plants. In the mosses and ferns it refers to the fact that in certain species one gametophyte (prothallium in ferns) bears

the antheridia and another the archegonia. In seed plants it refers to the fact that one sporophyte produces the stamens (microsporophylls) and another produces the carpels (megasporophylls). As thus applied, the name has no morphological significance; but in both cases it refers in a sense to a similar physiological condition. If the diœcism, as exhibited by mosses and ferns, be strictly traced into the seed plants, it is discovered that they are all diœcious, for in all of them the male cells and eggs are produced by different gametophytes. This is merely a result of heterosporry, and hence heterosporous plants are essentially diœcious, if considered from the standpoint of the sex organs.

The significance of the diœcism of seed plants is not clear, although many see in it a condition which secures all of the advantages of cross pollination. On the other hand, it is in general a primitive condition, for many gymnosperms and the most primitive angiosperms are diœcious. Although prevalingly displayed by the more primitive groups of seed plants, it is by no means wanting in the highest groups, so that it is not an essential indication of either a primitive or a derived condition. There are cases in which it is evident that the diœcious habit is a derived one, since in the stamen-bearing flowers rudiments of the carpels may be found, and in the carpel-bearing flowers rudiments of stamens often occur. It is evident that in such cases the diœcious condition has come from what is called the bisporangiate condition, i.e., one in which the two sets of sporangia occur in the same flower. Diœcious flowers are necessarily monosporangiate; but flowers may be monosporangiate and yet both kinds of flowers may occur upon the same individual. The monosporangiate and diœcious conditions are therefore not synonymous.

**DIOGENES**, dī-ōj'e-nēz (Lat., from Gk. Διογένης) (c.412-323 B.C.). A Cynic philosopher, a native of Sinope, in Pontus. His father, Icesias, a banker, was convicted of debasing the coinage, and his son, being implicated in the matter, was obliged to leave Sinope. On his way to Athens he attached himself to a Cynic, by whom, however, his first advances were repelled. In spite of his inhospitable reception Diogenes renewed the attempt to find favor with Antisthenes; though driven away by blows, by his perseverance he at last prevailed, and Antisthenes, moved with compassion, consented to admit him as a pupil. Diogenes now plunged into the extreme of austerity and self-mortification. His clothing was of the coarsest, his food of the plainest, and was provided by the pity of the Athenians. His bed was the bare ground, whether in the open street or under the porticoes. On one occasion, in default of a better place, he took up his residence temporarily in a huge jar, *πλοῖς*, in the Metroun, that thereby he might show his contempt of ordinary men. His life did not, however, cost him the respect of the Athenians, who admired his contempt of comfort and allowed him a wide latitude of comment and rebuke. Practical good was the chief aim of his philosophy; for literature and the fine arts he did not conceal his disdain. He laughed at men of letters for reading the sufferings of Odysseus while neglecting their own; at musicians who spent in stringing their lyres the time which would have been much better employed in making their own discordant natures harmonious;

at savants for gazing at the heavenly bodies, while sublimely incognizant of earthly ones; and at orators who studied how to enforce truth but not how to practice it. He was seized by pirates on a voyage to Ægina and carried to Crete, where he was sold as a slave. When asked what business he was proficient in, he answered, "In commanding." He was purchased by a certain Xenias of Corinth, who recognized his worth, set him free, and made him tutor to his children. It is here that he is said to have had his famous interview with Alexander the Great. The King opened the conversation with, "I am Alexander the Great," to which the philosopher answered, "And I am Diogenes the Cynic." Alexander then asked him in what way he could serve him, to which Diogenes rejoined, "You can stand out of the sunshine." Alexander is said to have been so struck with the Cynic's self-possession that he went away remarking, "If I were not Alexander, I should wish to be D . . ." Diogenes died at Corinth, according to . . . on the same day with Alexander the Great. Diogenes was wholly concerned with practical wisdom and established no system of philosophy. He represented at its best the teaching of the cynics; to gain virtue, he held, one must avoid all physical pleasure, and must turn away from the conventions of society, as things harmful to truth and goodness, to a simpler and more natural life. Certain literary works were early attributed to him, but were recognized even in antiquity as spurious. Consult: Hermann, *Zur Geschichte und Kritik des Diogenes von Sinope* (Heilbronn, 1860); Zeller, *Philosophie der Griechen*, vol. i (1889); Windelband-Bonhöffer, *Geschichte der antiken Philosophie* (3d ed., Munich, 1912).

**DIOGENES CRAB.** See HERMIT CRAB.

**DIOGENES LAERTIUS**, lā-ēr'shī-ūs. A Greek writer, a native, perhaps, of Laërte, in Cilicia. He flourished apparently about the beginning of the third century A.D. The details of his life are not known to us. His chief work, *Lives of Philosophers*, in 10 books, is a history of Greek philosophy from its beginning. Diogenes, however, lacked the ability to handle his subject, and his interest lay rather in collecting biographical anecdotes and selecting passages from the works of his predecessors than in undertaking a critical account of the development of philosophic thought. Furthermore, he drew, not from original works, but from compendia and histories, especially from the writings of Diocles of Magnesia, author of a brief account of philosophers, and Favorinus (q.v.). Yet his work has preserved many valuable facts of which otherwise we should be ignorant. Especially interesting is the last book, which deals with Epicurus alone; it contains three letters of Epicurus to Herodotus, Pythocles, and Menæceus. The authenticity of the second letter, however, is questioned. Diogenes also composed epigrams, some of which are quoted in his larger work. The text of the *Lives* was edited by Cobet (Paris, 1850, 1862); for a commentary, consult the edition by Hübner and Jacobitz (1828-33). In Bohn's Classical Library there is a translation by Yonge. Consult Christ-Schmid, *Geschichte der griechischen Literatur*, vol. ii (5th ed., Munich, 1913). For the value of Diogenes to the student of Greek philosophy, at least on its biographical side, consult passim such a work as Ritter and Preller,

*Historia Philosophiæ Græcæ* (9th ed., Gotha, 1913).

**DIODENES OF APOLLONIA.** A Greek philosopher, a pupil of Anaximenes and a contemporary of . . . who flourished in Athens in the first half or the fifth century B.C. He believed air to be the source of all being, and all other substances to be derived from it by condensation and rarefaction. He also recognized an intelligent principle, in that he believed air to be endowed with consciousness and intelligence, but did not distinguish between mind and matter. Of his most important work, *Περὶ Φύσεως*, *Peri Physeos*, 'On Nature,' considerable . . . in, especially in Simplicius. . . . *Philosophie der Griechen*, vol. i (Leipzig, 1892), and Ritter and Preller, *Historia Philosophiæ Græcæ* (9th ed., Gotha, 1913).

**DIODENIANUS** (Lat., from Gk. Διογενειανός, *Diogeneianos*). A Greek grammarian of Heraclea, who lived in the middle of the second century A.D. His epitome, in five books, of the collection of glosses compiled, about a century before, by the Alexandrian grammarian Pamphilus (q.v.), is believed to have been the basis of the lexicon of Hesychius (q.v.). Diodenianus' work was known as the *Περίεργονέμης*, *Periergopenēs*, 'Poor Students' Lexicon.' A portion of the work, containing a collection of proverbs made by him, is preserved in an abridged form in the *Paræmiographi Græci*, edited by Von Leutsch and Schneidewin (1839).

**DIODINETUS** (Lat., from Gk. Διόνητος), EPISTLE TO. A Greek Christian work, of unknown authorship, commonly included among the Apostolic fathers (q.v.), but properly belonging to the apologetic literature of the early Church. In the Strassburg manuscript, our sole authority for the text, which was destroyed by fire in 1870, the work was attributed to Justin, but it is improbable that he was its author. The lack of external testimony to the Epistle renders the question of its date a difficult one. If we could be sure that the "Diognetus" to whom it is addressed was the teacher of Marcus Aurelius, as Lightfoot suggested, the problem would be easier. But of this we are by no means certain. Some extreme critics have conjectured that the work is a fifteenth-century forgery. Others, with much greater probability, assign it to the second, or the early part of the third, century. In view of internal resemblances some have inclined to the opinion that it proceeds from the same author as the recently recovered Apology of Aristides, which was written before 150 A.D. Date and authorship, however, remain matters of conjecture. The last two chapters are evidently a later addition and from a different hand.

The Epistle is an excellent product of Christian . . . writing, evangelical in character, . . . tone, and clothed in language which . . . almost of poetic beauty. Its contents are determined by the questions Diognetus has asked, e.g., what god the Christians worship, why they despise death, what is the explanation of their mutual love, and why their new life motive did not sooner enter the world. In replying to these inquiries the author shows special familiarity with Pauline and Johannine . . . He sets forth Christianity on its . . . placing emphasis upon godly living rather than upon correct dogmatic be-

lief. Yet he combats with vigor the errors of the Jews and Greeks, very much after the fashion of the Apology of Aristides, arguing for the superior rationality of the Christian faith.

For the Greek text, consult: K. Otto, *Corpus Apologetarum Christianorum*, ii (3d ed., Jena, 1879); for the text with Eng. trans., Lightfoot, *The Apostolic Fathers* (London, 1893); for Eng. trans., A. C. Cox, *The Ante-Nicene Fathers*, i. Consult also, in general: G. Krüger, *History of Early Christian Literature* (trans., New York, 1897); the article "Diognetus" in Smith and Wace, *Dictionary of Christian Biography*; Harnack, *Chronologie der altchristlichen Litteratur*, i (Leipzig, 1893).

**DIOMEDE ISLANDS.** Two small islands situated near the middle of Bering Strait, in about lat. 66° N. and long. 169° W., forming as it were stepping-stones between the nearest points of Asia and North America. They were discovered by Popof in 1711. Big Diomede, or Romanzof, pertains to Russia, but Little Diomede, or Krusenstern, belongs to the United States and affords scanty means of livelihood for its native population (90 in 1910). The United States maintains a school on the island.

**DIOMEDES** (Lat., from Gk. Διομήδης). The son of Tydeus and Deïpylos and King of Argos. He plays a prominent part in the legend of the Trojan War, where he appears as the companion of Odysseus in many adventures, such as the bringing of Achilles from Scyros, the carrying off of the horses of Rhesus, and the theft of the Palladium. At the funeral games of Patroclus he is victor in the chariot race. He played a large part too in the capture of Troy. Returning to Argos, he found that Aphrodite, in revenge for the wound which he had given her in a battle before Troy, had caused his wife to become unfaithful. In grief he left Argos and, according to the later tradition, went to Italy, where he was honored in a number of the southern cities, as Metapontum and Thurii. Arpi in Apulia, Canusium, Brundisium, and several other towns claimed him as their founder. Consult the article "Diomedes," by Bethe, in Pauly-Wissowa, *Real-Encyclopädie der classischen Altertumswissenschaft*, vol. v (Stuttgart, 1905).

**DIOMEDES.** In Greek legend, the son of Mars and Cyrene, and King of the Bistones in Thrace. He fed his mares upon the flesh of strangers, until Heracles, as his eighth labor, slew him and brought his mares to Eurystheus. According to one story, Heracles threw him to his mares to be devoured.

**DIOMEDES.** A Roman . . . of the fourth century A.D.; author of *Ars Grammatica*, an extant treatise on grammar. The work, which is in three books, is founded on the same sources as the *Institutiones Grammaticæ* of Charisius and is valuable chiefly for its quotations from earlier authorities now lost and for its comments on literary history contained in the third book and borrowed from the *De Poetis* of Suetonius. The text is printed in Keil's edition of the *Grammatici Latini* (vol. i, p. 298 ff.). On Diomedes' Latinity, consult Paucker, *Kleinere Studien*, vol. i (Berlin, 1883).

**DIOMEDES, VILLA OF.** The name given to one of the villas outside Pompeii, beyond the Herculanean Gate, excavated in 1771-74, and so called from the tomb of Marcus Arrius Diomedes, which faces it on the opposite side of the Street of Tombs. It was an extensive

and very completely appointed establishment, built . . . . . before the time of Augustus. The . . . . . occupies a lower level than the front and contains a colonnade surrounding a garden. In the wine cellar beneath the colonnade 20 skeletons were discovered in the course of the excavation, and 14 in other parts of the house. For an account of the villa, with a plan, consult Mau-Kelsey, *Pompeii: Its Life and Art* (2d ed., London, 1911).

**DION** (Lat., from Gk. Δίων) (c.410–354 B.C.). A Syracusan, son of Hipparinus, the brother-in-law of Dionysius the Elder, and a pupil of Plato. His lofty character secured for him the hostility of the King, Dionysius the Younger, and in 366 B.C. he was banished. Dion lived quietly at Athens for several years. When Plato, once more in Sicily, interceded with Dionysius in Dion's interest, Dion's property was confiscated, and his wife, Arete, was given to another man. Dion, now desiring to free his country from the tyrant's rule, returned to Syracuse with a small force, in 356. He took the city and expelled Dionysius, but was himself shortly after compelled to give up his power and withdraw to Italy. Being soon recalled by popular vote, he made himself tyrant of Syracuse and master of Sicily, but was assassinated about 354 by one Calippus.

**DIONÆA** (Lat., fem. of *Dionæus*, pertaining to *Dione*, Gk. Διώνη, *Diōnē*, name of Venus). A most remarkable insect-catching plant belonging to the order Droseraceæ. The single species, *Dionæa muscipula*, is popularly known as Venus's flytrap because of the peculiarly trap-like fly-catching organ developed at the summits of its leaves. This plant is a small, relatively inconspicuous, perennial herb, growing native in bogs in North and South Carolina, and because of its interesting habits often kept in greenhouses. From the midst of the circlet of root leaves arises a slender scape 10 to 12 inches in height, at the summit of which is a cyme of small white flowers. The leaf is divided into two parts—a lower, simple, spatulate portion, above which, and separated by a narrow constriction, is the flytrap. This organ forms the bilobed upper portion of the leaf, each lobe of which is reniform, with the edge provided with spiny bristles. The lobes hinge upon the midrib and have upon their inner surfaces a few extremely sensitive hairs. When these hairs are irritated by an insect, the lobes, under favorable conditions of temperature, suddenly close, the marginal spines catching the insect after the manner of a steel trap. If the insect is caught, the trap remains closed and, by means of secretions from the glandular inner surface of the lobes, the soft parts of the insect are digested and elaborated as food for the plant. After digestion and absorption, which may occupy two or three weeks, have been completed, the trap opens and only the chitinous skeleton of the insect remains. If the insect is not caught, the trap opens within an hour or so and is ready for the next trespasser. A single leaf seems to be capable of digesting only a few insects, after which its vigor diminishes; it responds less actively to excitation of the glandular surface and soon dries up or decays. Consult Darwin, *Insectivorous Plants* (New York, 1892).

**DIONE**, di-ō'nē (Lat., from Gk. Διώνη). A Titan associated with Zeus at Dodona (q.v.) as his wife; and by him the mother of Aphro-

dite, who is therefore sometimes called Dionæa (see *Iliad*, v, 370). John Gay wrote a pastoral drama under this title (1720). Consult Hadzsits, "Aphrodite and the Dione Myth," in *American Journal of Philology*, 30 (1909).

**DIONNE**, də-ōn', NARCISSE EUTROPE (1848–). A Canadian author and librarian. He was born at Saint-Denis de la Boutellerie and was educated at Sainte-Anne's College, the Quebec Grand Seminary, and Levis College. He graduated in medicine at Laval University in 1872 and practiced at Stanfold, P. Q., but later took up journalistic and literary writing. He was editor of *Le Courrier du Canada* and then of *Le Journal de Québec*, and after 1892 he was chief librarian of the Quebec Legislature. He was elected a fellow of the Royal Society of Canada. Among his numerous publications are: *Histoire de l'église de Notre Dame des Victoires* (1888); *Jacques Cartier* (1889); *La vie de C. F. Painchaud* (1894); *Les ecclésiastiques et les royalistes français réfugiés au Canada à l'époque de la révolution, 1791–1802* (1905); *Champlain* (1905); *Chouart et Radisson* (1910); *Gabriel Richard, Sulpicien* (1911); *Une dispute grammaticale en 1842* (1912).

**DIONYSIA**, di-ō-nish'i-ā. See GREEK FESTIVALS.

**DIONYSIACA** (Lat., from Gk. Διονυσιακά, *Dionysiaka*). A long epic in 48 books, by the Greek poet Nonnus, of Panopolis in Egypt, dating probably from the fifth century B.C. It recounts the . . . . . of Dionysus in the East and is one of the chief sources for the legends concerning the god.

**DIONYSIUS**, di-ō-nish'i-ūs (Lat., from Gk. Διονύσιος, *Dionysios*), surnamed THRAX ('the Thracian'). A Greek grammarian, native of Alexandria, who taught at Rhodes and at Rome in the first century B.C. His *Art of Grammar* (*Τέχνη Γραμματική*) is the foundation of all subsequent European works on grammar. The best edition is that of Uhlig (Leipzig, 1884). For an excellent account of the work, consult Sandys, *A History of Classical Scholarship*, vol. i (2d ed., Cambridge, 1906). Dionysius wrote much also on Homer.

**DIONYSIUS**, or **DINIZ**, də-nēz' (1261–1325). The sixth King of Portugal. He was the son of Alfonso III of Portugal and the grandson of Alfonso X of Castile and was born Oct. 9, 1261. He succeeded his father in 1279 and after some difficulty effected a compromise with the Pope regarding the privileges of the clergy. His brother attempted to supplant him, on the plea that he was illegitimate by birth, but was soon subdued. Later Dionysius' son, jealous of a favorite, raised the standard of rebellion. By the intercession of the Queen mother, Isabel of Aragon (afterward canonized), war was avoided, and the son was allowed to exercise a powerful influence over the policy of the government. The reign of Dionysius was a period of reform. The administration of civil and criminal justice was changed and the power of the great lords curbed. Industry and commerce were fostered, the mines were made a fruitful source of revenue, and fortifications were built in more than 40 places; because of his interest in improving methods of agriculture, he became known as "the farmer king." He was a patron of literature and himself wrote poetry. About 1291 a university was founded at Lisbon, which in 1306 was transferred to Coimbra. The military Order of



Christ. founded in 1318 by Diniz and Pope John XXII, was endowed with the confiscated property of the Templars. Dionysius was one of the most liberal princes of his time, and won the title of the "father of his country." He died Jan. 7, 1325. Consult Schaefer, *Geschichte von Portugal*, vol. i (2d ed., Hamburg, 1874).

**DIONYSIUS, EAR OF.** The name given, since the sixteenth century, to one of the Lautumiae, or quarries, of Syracuse, known now as the Latomia del Paradiso, a grotto hewn in the rock in the form of the letter S, 210 feet deep, 74 high, and 15-35 wide; it contracts towards the summit. The shape of the grotto is due to the rounding of the adjoining theatre. Since it is related of Dionysius the Elder that he constructed prisons with such acoustic properties that at a given point he could overhear the conversation of the prisoners, this remarkable grotto has, not unnaturally, gained its present name.

**DIONYSIUS, SAINT.** Pope, 259-268. He was a Greek by birth and must have been among the most distinguished members of the Church in Rome, even before his elevation, as his distinguished namesake of Alexandria addressed to him two letters on different subjects: afterward the teaching of the latter on the Trinity was reviewed by him in a synod held in 262 and was the occasion of a notable letter to the Egyptian churches. He did much to reorganize the church after the severe persecutions to which it had been subject. His day in the calendar is December 26.

**DIONYSIUS EXIGUUS** (Lat., Dionysius the Little). A learned monk who lived in the fifth and sixth centuries. The epithet of *Exiguus* is merely a term of humility, used by Dionysius himself. Cassiodorus (q.v.), who was his fellow pupil, says that Dionysius was "a Scythian by birth, but wholly Roman in other respects." He made a collection containing (1) the first 50 canons of the Apostles; (2) the canons of 10 councils; (3) 38 decretals of the popes, from 384 to 498. This collection, of which there were two redactions, had great authority in the West. Somewhat changed, it was solemnly promulgated by Charles the Great in 802. (See CANON LAW.) Dionysius completed the paschal cycle and introduced the custom of counting the years from the birth of Christ. (See CHRONOLOGY.) He died before 555. Various works of Dionysius are printed in Migne's *Patrologiae Latinae Cursus Completus*, vol. lxvii. But this, as well as the earlier editions, is uncritical and incomplete. Consult Tardif, *Histoire des sources du droit canonique* (Paris, 1887).

**DIONYSIUS OF ALEXANDRIA, SAINT,** called the Great (?-265). An early Christian writer. He was born at Alexandria of a noble pagan family, but was an early convert to Christianity and under the influence of Origen became a priest, and head of the famous catechetical school in 231. In 248 he became Bishop of Alexandria, but continued to hold his former position. In the persecution of Decius (250) he was arrested and condemned to death, but was rescued by peasants and remained concealed for a year in the Libyan desert. In 257 he was again exiled, but restored three years later. His day is November 17. Most of his works are lost. Such as remain are in Migne, *Patrol. Graeca*, vol. x; Eng. trans. in *Ante-Nicene Fathers*, vol. vi. Consult: Förster, *De Doctrina*

*et Sententiis Dionysii Magni* (Berlin, 1865); and for his biography, Dittrich (Freiburg, 1867), Paul Morize (Paris, 1881), and *Letters and Other Remains*, ed. by Feltoe (New York, 1904); Harnack, *Geschichte der altchristlichen Literatur*, vol. i (Leipzig, 1893).

**DIONYSIUS OF HALICARNASSUS.** A learned critic, antiquarian, and rhetorician. He was the son of one Alexander of Halicarnassus and was born probably about the middle of the first century B.C. He came to Rome at the termination of the civil wars (29 B.C.), and resided there for 22 years, familiarizing himself with the language, literature, and antiquities of the Romans. He taught rhetoric and was intimate with many men of distinction. His death occurred after 7 B.C. Dionysius' most valuable work is unquestionably his *Antiquities of Rome*, although it does not exhibit the finest qualities of his mind. This work treats the history of Rome from the mythical period down to the First Punic War. The author was an admirable rhetorician, but had very little political discrimination, and no perception of the difference between a myth and an historic fact. Yet, inasmuch as this work contains a mine of information about the constitution, religion, history, laws, and private life of the Romans, it will always command the regard of scholars. Of the 20 books we possess only the first nine in a complete form, the tenth and eleventh nearly so; of the rest, only a few fragments survive. Dionysius' work was much used by Appianus (q.v.). The first edition of the Greek original was that by Stephens (Paris, 1546), but a very good Latin version was published as early as 1480. Angelo Mai published (Milan, 1816) a collection of the fragments of the lost books from a manuscript in the library at Milan, the genuineness of which has been doubted. The rhetorical and critical works of Dionysius are of the highest literary merit. These include: *Censura Veterum Scriptorum*; *Ars Rhetorica*; *De Compositione Verborum*; *De Imitatione*; and special treatises *On the Style of Demosthenes* and *On the Character of Thucydides*. All these works are in Greek. The complete works are edited by Usener and Rademacher (Leipzig, 1899); a good edition of the *Antiquities* is that of Jacoby (ib., 1885-91). W. Rhys Roberts has published editions, with translations, notes, glossaries, etc., of *The Three Literary Letters* of Dionysius, two addressed to Ammaeus, one to Pompeius (Cambridge, 1901), and the *De Compositione Verborum*, 'On Literary Composition' (London, 1910): the former work contains valuable historical and literary material. Consult also Bo-

bus *Dionysii Halicarnensis*, in *Leipziger Studien*, vol. xvii (1895); Sandys, *A History of Classical Scholarship*, vol. i (2d ed. Cambridge, 1906).

**DIONYSIUS PERIEGETES** (Lat., from Gk. Διονύσιος Περιηγητής). A Greek geographer, author of a Greek poem in 1187 excellent hexameters, entitled *Τῆς Γῆς Οἰκουμένης Περιήγησις*, 'A Description of the Habitable World.' The time and place of his birth are not known. Some place him in the time of Hadrian; others in the latter part of the third or the beginning of the fourth century A.D. His work enjoyed a wide popularity in ancient times and was translated into Latin by Rufus Festus Avienus (q.v.) and by Priscianus. A Greek paraphrase and scholia and a valuable commentary upon it by Eustathius (q.v.) are still extant. The best editions of the *Periegesis* are those by Bernhardt

in *Geographi Græci Minores*, vol. i (Leipzig, 1828), and by Müller, in *Geographi Græci Minores*, vol. ii (Paris, 1861). Consult Bunbury, *Ancient Geography*, vol. ii (London, 1879), and Bernays, *Studien zu Dionysius Periegetes* (Heidelberg, 1905).

**DIONYSIUS THE AREOPAGITE.** A member of the court of Areopagus (q.v.), at Athens, converted to Christianity through the preaching of Paul (Acts xvii. 34). . . . is known about him. Eusebius, on . . . of Dionysius, Bishop of Corinth, about 175 A.D., records that he was the first Bishop of the church of Athens, and a much later historian says he was martyred there in the reign of Domitian.

to still another tradition, perpetuated by Hilduin (814-840), the abbot of Saint-Denis, he was sent by Clement of Rome into Gaul (Paris), where he died a martyr on Montmartre. There is evident confusion between Dionysius and Saint-Denis (q.v.), patron saint of France, who, according to Gregory of Tours, founded the church in Paris in the third century.

In the sixth century we meet with a body of writings which bear the name of Dionysius Areopagita. Ecclesiastical tradition ascribed them to Paul's Athenian convert, but it is certain that they are the work of a Christian Neoplatonist of the sixth century. The first of these works, entitled *The Celestial Hierarchy*, deals with the three triads of orders of angelic beings; the second, *The Ecclesiastical Hierarchy*, with their three triads of earthly counterparts. Heaven and earth are thus woven together into one grand structure of correspondencies, suggesting the later system worked out by Swedenborg (q.v.). Through these graded hierarchies God communicates Himself to man. The treatise on *Divine Names* inquires what the names applied to the Deity in scripture can teach us respecting His nature and attributes. In the *Mystic Theology* the author explains the significance of the system of symbols which he has hitherto employed and sets forth an intuitive mysticism, the soul's rapture to the divine. It is here especially that, through the pseudo-Dionysius, Neoplatonic and Christian mystics are brought into one line of historical development, for it can be shown that our author drew largely from the Neoplatonists Plotinus and Proclus.

The pseudo-Dionysiac writings were probably produced in the East. Syria and Egypt have been conjectured to have been their home. They are first cited at the Council of Constantinople (553). Their influence appears in the system of the great doctor of the Eastern church, John of Damascus. In the West they are not found prior to Gregory the Great (died 604), but throughout the Middle Ages they exerted a vast influence upon the thought of Christian Europe. In the ninth century Hilduin, abbot of Saint-Denis, wrote a life of Dionysius which gained wide currency, and not long afterward, in the reign of Charles the Bald, the learned John Scotus . . . translated his supposed works into . . . this more accessible form they furnished a prolific source of inspiration to the scholastic theologians, especially . . . Saint-Victor and Thomas Aquinas. . . . tine Platonists of the fifteenth century studied them with ardor, as did the English Humanists, Colet and Grocyn. Their influence is plainly traceable in Dante's *Divine Comedy* and even in Milton. Laurentius Valla and Erasmus cast doubt upon the prevalent belief that these writ-

ings were from the pen of the Athenian Dionysius, but their authenticity was stoutly defended by many writers, and the controversy became very vehement. Now, however, both Catholic and Protestant scholars are agreed that their origin is about the close of the fifth century.

The works of pseudo-Dionysius were edited by Corderius and reprinted in Migne, *Patrol. Græc.* vols. iii, iv (Paris, 1857). An edition of the *De Cælesti seu Angelica Hierarchia* appeared at Freiburg, 1902. For an English translation, consult J. Parker, *The Works of Dionysius the Areopagite* (London, 1897); also, in general, the article "Dionysius," in Smith and Wace, *Dictionary of Christian Biography* (ib., 1877-87); and Hugo Koch, *Pseudo-Dionysius Areopagita in seinen Beziehungen zum Neuplatonismus und Mysterienwesen* (Mainz, 1900). For Hilduin's life, identifying him with Saint-Denis, consult Migne, vol. cvi. Consult also Vaughan, *Hours with the Mystics* (London, 1860).

**DIONYSIUS THE ELDER** (431-367 B.C.), Tyrant of Syracuse. He began life as a clerk in a public office. He fought with distinction against the Carthaginians, with whom the Syracusans had been at war since 410 B.C. After the loss of Agrigentum through the failure of the Syracusan generals to relieve the town, he accused the commanders and secured the appointment of other officers, of whom he was himself one. He soon, however, supplanted his colleagues and made himself tyrant of the city, in 406 B.C. He had already provided himself with a bodyguard of 1000 men, and he now . . . his position by marrying the daughter of Hermocrates, the leader of the aristocratic party. The time from this latter event to 397, when the next war with Carthage began, he employed in strengthening and extending his power in Sicily. In the new war with Carthage he was at first successful in his operations, but when, in 396, fresh troops were sent to the island, he found himself blockaded in Syracuse and in serious danger of being deprived of his power. But, a pestilence breaking out in the Carthaginian fleet, the tyrant seized the opportunity to surprise the enemy's fleet and army. He was shrewd enough, however, not to push his advantage too far and turned his attention next to those Greeks, especially in lower Italy, who were still independent. In 392 he was interrupted in his plans by a renewal of hostilities by the Carthaginians, but this . . . was soon terminated by a peace, in which Carthage recognized Dionysius as ruler of a large part of eastern Sicily. He now once more turned to lower Italy, and in 387, after a siege of 11 months, captured Rhegium. Thus the whole southern corner of Italy came under his rule. In 383 and again in 379 he found himself in conflict with the Carthaginians, who on both occasions tried to attack him by way of lower Italy. From this time, till his death in 367, he ruled without opposition. His influence was great throughout the Grecian world. In 373 he assisted the Spartans against the Athenians; in 369 he supported the Thebans, who were then invading the Peloponnesus, and in 368 his troops took part in the Tearless Battle on the side of Sparta. As a ruler, Dionysius was cruel and unscrupulous. He did much, however, for the material prosperity of Syracuse, which under his rule became the most brilliant of Grecian cities. He sent deputies to the Olympic games, and himself contended for the prize of tragedy at Athens,



in 367 the first prize for a tragedy *Ransom of Hector*. He aimed also to have a literary court and attracted thereto at different times the lyric poet Philoxenus (q.v.), the philosopher Aristippus (q.v.), and Plato. Consult: Holm, *Geschichte Siciliens*, vol. ii (Leipzig, 1874); Grote, *History of Greece*, vols. x, xi (London, 1852-53); Bass, *Dionysius I von Syracus* (Vienna, 1881); Freeman, *History of Sicily*, vols. iii, iv (Oxford, 1891-94). See SICILY; SYRACUSE.

**DIONYSIUS THE YOUNGER.** Tyrant of Syracuse after the death of his father, Dionysius the Elder, in 367 B.C. He began his rule peacefully at the age of 28, but, having been from motives of jealousy neglected by his father, he was entirely unfitted for his position. His kinsman, Dion (q.v.), conceived the idea of improving him by putting him under the instruction of Plato, but the influence of the historian Philistus (q.v.) proved to be stronger than that of Plato; Dion was sent into exile, Plato was dismissed, and Dionysius encouraged to pursue a course of pleasure. Afterward Plato was recalled to Syracuse, with even worse results. In 356 Dion returned to Syracuse at the head of a force of mercenaries, and Dionysius was obliged to leave Sicily. He retired to Locri in Italy, the birthplace of his mother, Doris, and ruled there despotically until 346, when he once more obtained possession of the island at Syracuse. His rule was so oppressive that the Syracusans finally sought aid of Corinth, and Timoleon (q.v.) was sent to their assistance. Dionysius was shut up in the citadel of Syracuse and compelled to surrender, 343. He was taken to Corinth, where he remained till his death.

**DI'ONY'SUS.** See BACCHUS.

**DIONYSUS, THEATRE OF.** The oldest known theatre in the world, lying against the slope of the Acropolis at Athens, at the southeastern corner. It has been the scene of excavations by the German Archaeological Institute since 1886, largely under Dörpfeld (q.v.). The results of the researches show, in the opinion of some scholars, that no permanent building for dramatic representations had existed on the spot until about 330 B.C., when Lycurgus built a stone theatre. Others, however, hold that there was a stone auditorium at a much earlier date. Lycurgus' theatre was transformed into a Roman theatre, first in Nero's time, then further in the days of Hadrian. Consult: Dörpfeld-Reisch, *Das griechische Theatre* (Athens, 1896); E. Gardner, *Ancient Athens* (New York, 1902); Haigh, *The Attic Theatre* (3d ed., Oxford, 1907); M. L. D'Ooge, *The Acropolis of Athens* (New York, 1908); Weller, *Athens and its Monuments* (ib., 1913).

**DIOON**, δι-ὄν. See CYCADACEÆ.

**DI'OPHANTINE ANALYSIS.** That portion of the theory of indeterminate problems which seeks rational and commensurable roots of equations involving the squares and cubes of the unknown quantity. This class of problems was first and chiefly treated by Diophantus (q.v.), whose name the method bears. Although Diophantus gave problems involving the indeterminate linear equations, he was chiefly interested in solving equations of the second degree: e.g., to find two whole numbers, the sum of whose squares is a square; or to find three square numbers in arithmetic progression. The method of Diophantus, being neither concise nor definite, does not admit of a brief exposition.

The following are, however, some of its characteristics: 1. His quantitative symbolism was limited to that of one unknown. 2. His rules of operation are the common axioms of adding to and subtracting from both members of an equation. 3. He showed much adroitness in selecting the unknown; e.g., so as to avoid affected quadratics or complete cubics. 4. He also showed skill in his tentative assumptions, in assigning separately to the unknown quantity preliminary values which satisfy one or two only of the necessary conditions; then, from its failure to satisfy the remaining conditions, he discovered the required number, a method somewhat analogous to the *regula falsi* (q.v.). 5. He used the symbol for the unknown in different senses, which amounted to the same thing as substituting one unknown for a function of another. 6. He made some use of limits: e.g., to find a square between 10 and 11, Diophantus proceeds thus: No square lies between 40 and 44, nor between 90 and 99, but 169 lies between 160 and 176. These numbers being 16 times 10 and 11, respectively, the square between 10 and 11 is  $\frac{169}{256}$ . 7. He developed the use of synthesis (q.v.). 8. He showed skill in the introduction of arbitrary conditions: e.g., two numbers being sought such that the cube of one is greater by 2 than the square of the other, Diophantus arbitrarily assumes that the numbers are  $x + 1$ ,  $x - 1$ . The strength of this analysis does not consist in the elegance and definiteness of the method, but in the consummate skill with which Diophantus makes use of the above devices. Diophantus' name is also associated with the following theorem: The sum of the squares of any three integers can never be expressed as the sum of two such squares. Fermat first proved this theorem and added the corollary: It is impossible that any multiple of a prime of the form  $4n - 1$ , by a number prime to it, can either be a square or the sum of two squares, integral or fractional.

**DIOPHANTINE THEOREM.** See DIOPHANTINE ANALYSIS.

**DI'OPHANTUS** (Lat., from Gk. Διόφαντος). A Greek mathematician, who lived at Alexandria probably in the second half of the third century. He is called the Father of Algebra. He occupied himself chiefly with a class of problems discussed under DIOPHANTINE ANALYSIS (q.v.). Of his three works, (1) on *arithmetic*, (2) on *polygonal numbers*, (3) the *porisms*, the *Arithmetica* consisted originally of 13 books, only six of which are extant. The polygonal numbers may have been one book of the *Arithmetica*, and the *Porismata*, which is lost, may also have been part of it. The best-known editions of Diophantus' works are those of Bachet de Mézeriac (Paris, 1621); Schultz (Berlin, 1822); and Tannery (Leipzig, 1893-95). Consult: Heath, *Diophantos of Alexandria* (London, 1885; 2d ed., London, 1910); Gow, *History of Greek Mathematics* (Cambridge, 1884); Nesselmann, *Geschichte der Algebra der Griechen* (Berlin, 1842).

**DIOP'SIDE** (Gk. διόψις, *diopsis*, view through, from διὰ, *dia*, through + ὄψις, *opsis*, view). A variety of pyroxene that crystallizes in the monoclinic system and is essentially a calcium magnesium silicate. It is usually white or light gray, yellow, or green in color, although sometimes, owing to the presence of iron, it is dark green and nearly black. Diopside is a common mineral occurring in crystalline limestone and dolomite,

in serpentine or igneous rocks. Transparent, oily, green crystals, especially those from St. Lawrence Co., N. Y., have been found sufficiently large and clear to be cut into gems weighing from 6 to 8 carats each. A variety containing chromium that is deep emerald green in color has been found of sufficient size for small gems.

**DIOPTASE.** A basic copper silicate crystallizing in hexagonal forms and of a bluish color and vitreous lustre. It occurs in Hungary, Chile, and at the copper mines of Clifton, Ariz.

**DIOPTER, DIOPTRIC SCALE.** The unit adopted by ophthalmologists in measuring the strength of lenses used in the correction of defective vision. A concave or convex lens with a focal length of 1 meter is taken as the unit, and the reciprocals of the focal lengths supply the numbers which are assigned to the lenses. Thus a lens with a focal length of .5 meter would be designated as Number 2, and one with a focal length of .1 would be a Number 10. The measures are the same whether the lenses are positive (convex) or negative (concave), but in the former case the + sign is prefixed to the number, while in the latter it is the - sign.

**DIOPTOMETER** (Lat. *dioptra*, Gk. *διόπτρα* leveling instrument, from *διά*, *dia*, through + *όπτω*, *optō*, visual + *μέτρον*, *metron*, measure). An instrument used by oculists and opticians in measuring directly the curvature and focal length of glasses used to correct defective vision. It is based on the principle that the focal length of lenses of the glass usually employed is very nearly equivalent to one-half the sums of the radii of curvature. This follows from the formula that

$\frac{1}{f} = (\mu - 1) \frac{1}{r} + \frac{1}{s}$ , where  $f$  is the principal focus,  $\mu$  is the index of refraction, and  $r$  and  $s$  are the radii of curvature of the two surfaces. As  $\mu$  is 1.5, it will be

seen readily how all length can be obtained when once the two radii of curvature are known. The dioptrimeter is a simple arrangement of levers by means of which the curvature of any spherical surface is indicated, and the result shown in diopters. If the lens is plane, convex, or concave, the focal length is obtained directly by inspection, but if both surfaces of the lens are curved, the algebraical sum of the two readings must be taken.

**DIOPTRICS.** That branch of optics which deals with the refraction of light. See **LIGHT**.

**DIORITE** (from Gk. *διολίγειν*, *diorizein*, to distinguish, from *διά*, *dia*, through + *όρίγειν*, *horizein*, to divide, from *όρος*, *horos*, boundary). An igneous rock of granitic texture, the essential constituent minerals of which are a lime-soda feldspar and either hornblende or dark mica, or both of these minerals. The average chemical composition of diorite is about as follows: silica, 61 per cent; alumina, 16 per cent; ferric oxide, 3 per cent; ferrous oxide, 5 per cent; magnesia, 4 per cent; lime, 6 per cent; soda, 3 per cent; potash, 2 per cent. Many rocks formerly classified as diorites are now by many writers separated because of peculiarities of texture and of manner of occurrence; e.g., kersantite, amphibolite, aphanite, etc. In addition to lime-soda feldspar, hornblende, or mica, diorites may contain quartz, alkali feldspar, or augite, and other minerals in smaller quantities. According to the presence or absence of quartz, diorites are classified as quartz diorites or diorites proper. Each of

these groups is subdivided into mica diorites, hornblende diorites, or augite diorites, according as mica, hornblende, or augite predominates among the darker minerals. Peculiarities of texture alone serve to distinguish quartz diorites from dacites (q.v.), and diorites from andesites (q.v.), the composition being essentially the same. Chemically diorites differ from granites chiefly in containing less silica and potash and more lime, magnesia, and iron. Mineralogically they are distinguished by the greater abundance of lime-soda feldspar and by the darker color, due to the greater abundance of mica and hornblende. Diorite is often quarried for use as a building stone.

**DIOSCOREA/CEÆ** (Neo-Lat. nom. pl., named after the Greek physician and botanist Dioscorides). A family of monocotyledonous twining herbs and shrubs, with large tubers or rhizomes, of which the genus *Dioscorea* (see **YAM**) is the type. Some species bear aerial tubers in the axils of the leaves, as the air potato, one of the species of yams. There are about 9 genera and 200 known species. The most important plants of the order are the different species of *Dioscorea*, or yam, a number of which occur in the United States, *Dioscorea villosa* being the most common. Black bryony (*Tamus communis*) is a representative species in the European flora. *Dioscorea*, or *Testudinaria elephantipes*, a South African species, sometimes called elephant's foot, and Hottentot bread (q.v.), has a large, fleshy rhizome, with a rough cracked bark, which is used as food by the Hottentots in times of scarcity. The chief genera are *Dioscorea*, *Tamus*, and *Testudinaria*.

**DIOSCORIDES** (Lat., from Gk. *Διοσκορίδης*, *Dioskoridēs*), **PEDANIUS**. A Greek physician. He was a native of Anazarbus, in Cilicia, and flourished in the time of Nero. He accompanied the Roman armies as physician through many countries and collected a great store of information on plants. In his great work, *De Materia Medica*, in five books, he treats of all the medicinal substances then known and their properties. Two spurious works, *Alepharmaca* and *Theriaca*, assigned to him by Photius, are by a later Dioscorides of Alexandria. During 15 centuries Dioscorides maintained undisputed authority in botany and in materia medica, an authority which he still holds among the Turks and the Moors. The best edition is by Sprengel (2 vols., Leipzig, 1829); it contains a Latin translation and a commentary. The *De Materia Medica* was translated into Latin at an early date and later into all the vulgar tongues of western Europe. There is also an Arabic translation.

**DIOSCURIA.** See **CASTOR** and **POLLUX**.

**DIOSCURIAS.** See **COLCHIS** (end).

**DIOSPOLIS** (Lat., from Gk. *Διόσπολις*, city of Zeus). A name applied to several cities of antiquity. For Diospolis in Palestine, see **LYDDA**; and for those of Egypt, see **THEBES**.

**DIOSPYROS.** See **EBONY**; **PERSIMMON**.

**DIÓSY**, **ARTHUR** (1856- ). An English Orientalist. He was born in London, the son of Martin Diósy (1818-92), secretary to Louis Kossuth. He was educated in England and Germany and early became interested in the Far East, working for the Anglo-Japanese alliance and founding (1891) the London Japan Society. He edited two volumes of the Japan Society's *Transactions* and *Proceedings*, wrote and lectured on Japan, China, and the East in

general, and published *The New Far East* (1898; 8th ed., 1904).

**DIOTIMA**, di'ò-tí'mā (Lat., from Gk. Διοτίμα). The Mantinean priestess in Plato's *Symposium*, who describes in figurative language the doctrine of Platonic love.

**DIOXYGEN**. See HYDROGEN DIOXIDE.

**DIP** (AS. *dyppan*, *dippan*, to dip, Goth. *daupjan*, OHG. *toufen*, Ger. *taufen*, to baptize, from AS. *deop*, Icel. *djúpr*, Goth. *diups*, OHG. *tiof*, Ger. *tief*, Eng. *deep*). A term used by geologists to denote the inclination of rocks to a horizontal plane. Stratified and schistose rocks are seldom horizontal, and their dip may vary from a slight inclination to absolute verticality. The amount of dip (expressed in degrees) is measured by a clinometer (q.v.). When strata have been upraised into dome-shaped structures which have an outward slope in every direction from a central point, the dip is called "quâ-quâ-versal."

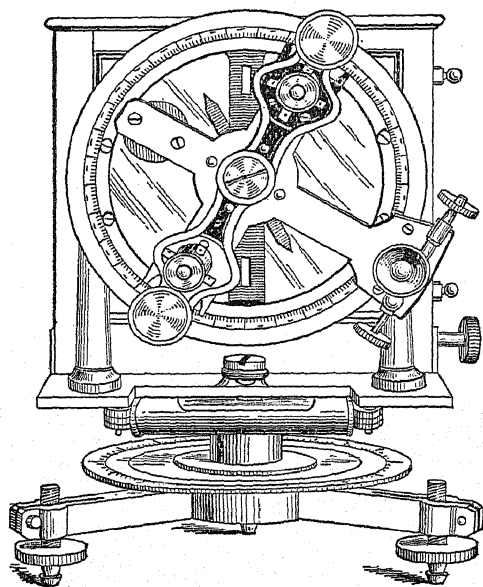
**DIP, MAGNETIC**. See INCLINATION, MAGNETIC.

**DIPAVANSA**, dē'pā-vān'sā (Pāli, *dīpa*, island + *vamsa*, lineage). The title given to the oldest chronicle history of the island of Ceylon. It is written in the Pāli language and dates from the fourth century of our era. An account is given in this old record of Buddha and the history of Buddhism in Ceylon down to the year 302 A.D. Like the other Ceylonese chronicle, the *Mahāvansa* (q.v.), to which it is akin, the *Dipavansa* is based on an older source. A record is preserved in the scholiast on the *Mahāvansa* that King Dhātusena (459-477 A.D.) caused the *Dipavansa* to be publicly read at an annual festival held in honor of Mahinda, the apostle who introduced Buddhism into Ceylon. The text of the *Dipavansa* has been edited and translated by Oldenberg, *The Dipavansa; An Ancient Buddhist Historical Record* (London, 1879); Gieger, *Dipavansa und Mahāvansa* (Erlangen, 1901; Leipzig, 1905).

**DIP CIRCLE**. If a magnetic needle be supported so as to be free to move in a vertical plane, at most places on the earth's surface, it does not rest in a horizontal position, but has a certain amount of inclination. If the vertical plane in which the needle moves contains the magnetic meridian of the place, the angle between the needle and the horizontal line is called the dip, or inclination, of the needle. The dip of the magnetic needle at any place can be ascertained with exactness by means of the dip circle. It consists of a graduated circle fixed vertically in a frame, which can be revolved about a vertical axis on a horizontal graduated circle. This last is supported on a tripod, or may be arranged on a gimbal stand for use on ship-board. At the centre of the vertical circle there are two knife-edges of agate, supported by the frame and parallel to the plane of the circle. The needle rests on these knife-edges by means of two fine polished cylinders of steel, which are placed accurately at the centre of the needle and project at right angles from it, or it may be mounted on jeweled bearings. The angle made by the needle can be read on the vertical divided circle by means of microscopes. The needle is carefully balanced so that before it is magnetized it will remain indifferently in any position; after magnetization, therefore, the dip which it shows is wholly due to the magnetic influence of the earth.

In order to understand how an observation is made with the dipping needle, we must regard

the directing force of the earth's magnetism exerted upon the poles of the needle in any vertical plane in which it may happen to be, as resolved into two forces—one acting at right angles to the plane, and the other acting in the plane. There being a corresponding but opposite force at each pole, we have thus two statical couples acting on the needle—one tending to turn it at right angles to the plane in which it moves, and the other tending to bring it round to a position in the plane such that the needle and the forces of the couple may be in a line. In the dipping needle the mode of support completely neutralizes the first of the couples; and the position that the needle takes in any plane is due wholly to the second. When the plane of the needle is at right angles to the magnetic meridian, the forces of this latter couple act vertically and bring the needle to a vertical position. This, then, gives us the means of determining the magnetic meridian, for we have only to bring the vertical circle round till the needle stands at 90° to put it in a plane at right angles to that meridian; and then by moving the vernier on the horizontal circle over 90°, we place the upper circle and needle in the plane of the magnetic meridian. The dipping needle may thus serve to determine approximately the magnetic declination. In bringing the needle round from the plane at right angles to the magnetic meridian the dip is less and less, till it becomes least in the plane of that meridian. We might thus also find the magnetic meridian, for it is that plane in which the dip of the needle is least. When the needle is in the plane of the magnetic meridian, the couple which acts in other vertical planes at right angles to them disappears, and the whole force of the terrestrial magnetism



DIP CIRCLE — KEW PATTERN.

acts at each pole of the needle, forming a couple which swings the needle round till it stands in a line with itself. The degree on the circle then pointed to by the needle is the dip at the place of observation. The method of observation is designed so as to eliminate all outstanding errors due, for example, to mechanical imper-

fections of construction, and to imperfect adjustments. The position of the needle when the dip is read off is manifestly the same that a needle suspended in air, if that were possible, and free to move in any way, would finally assume. In resolving, therefore, the total directive force of the earth as we have done above, we must keep in mind that it always acts parallel to the direction of the dipping needle.

The direction and intensity of the earth's magnetism may be roughly represented by supposing that there is a magnet at the centre of the earth whose length is very small in comparison with the earth's diameter, and which makes an angle of about  $11^\circ$  with the earth's axis of rotation. However, owing to the complex magnetization of the earth, a line . . . the earth's magnetic poles does not pass through the earth's centre but about 750 miles away from it. The magnetic equator is defined as the line along which the dip is everywhere zero. As we proceed from the magnetic equator towards the magnetic poles, the amount of dip increases from zero to  $90^\circ$ , and there is also a considerable change of dip from time to time at any one place. The dip in Paris was  $75^\circ$  when it was first observed in 1671, and from this it had fallen to  $65^\circ 18'$  in 1885, and at the present time is about  $65^\circ$ . See TERRESTRIAL MAGNETISM; INCLINATION.

**DI-PHENYL-AMINE DERIVATIVES.**  
See COAL-TAR COLORS.

**DIPHILUS** (Lat., from Gk. Διφίλος), of Sinope. An Attic poet, of the New Comedy, who flourished about 300 B.C.; a contemporary of Menander (q.v.). He is supposed to have written about 100 comedies, of which the titles and fragments of about 50 are still extant. He frequently took his subjects from common life and mythology, so that, though in point of time they belonged to the New Comedy, his works seem to have had more of the character of the Middle Period. The *Casina*, *Commoventes*, *Vidularia*, and *Rudens* of Plautus are modeled on plays of Diphilus, and Terence borrowed from his *Συναποθνήσκοντες*, in the *Adelphi*. The extant fragments of his works are collected in Meineke, *Fragmenta Comicorum Græcorum*, vols. i and iv (Berlin, 1839-57); and in Kock, *Comicorum Atticorum Fragmenta*, vol. ii (Leipzig, 1884). These fragments, and the judgments passed on Diphilus in antiquity, have led to the belief that he was one of the most gifted poets of his age.

**DIPHTHERIA**, or **DIPHTHERITIS** (Neo-Lat., from Gk. διφθέρα, *diphthera*, leather). An acute infectious and very . . . disease, caused by the Klebs-Löffler bacillus. (See PLATE OF DISEASE GERMS.) It is characterized by an inflamed throat in which a false membrane appears on the mucous membrane in patches, generally first on the tonsils, and then extending down to the larynx, up into the nasal passages, and into the mouth. It also appears on other mucous surfaces and upon any ulcer that may exist elsewhere. The false membrane is formed of lymph, which exudes upon the surface, together with mucus, pus, and the bacilli named. The mucous membrane is congested and swollen, and if the diphtheritic exudation be rubbed off, bleeding occurs, and the spot is very tender. The patient is very weak and depressed, suffers from fever, thirst, nervousness, insomnia, and loss of appetite. The throat is painful and the lymphatic glands in the neighborhood be-

come swollen and tender. Meningitis and Bright's disease frequently complicate diphtheria, and paralysis is a frequent occurrence during or a few weeks after the attack. The diagnosis of the disease is not always easy, and suspicious cases of tonsilitis are quarantined, as are all cases of undoubted diphtheria, till cultures made with mucus from the neighborhood of the tonsils have been examined microscopically for the bacilli of the disease. Besides separating the patient from the rest of the family by removing him to an upper room, from which carpets, upholstered furniture, and all cloth hangings have been removed, provision must be made for the nurse, so that she may change her clothing and disinfect her face, hair, and hands, before passing through the house for her daily airing out of doors. Quinine, mercury, iron, chlorate of potash, and alcoholic stimulants are used by physicians. The hypodermic injection of diphtheria antitoxin, introduced in 1894, gives by far the best results, as stated hereafter. Where antitoxin can be had, other treatment is merely symptomatic.

**History.** It is believed that an epidemic disease which existed anterior to Hippocrates (c.460-360 B.C.) was diphtheria. The malady is described by Aretæus of Cappadocia (c.100 A.D.) under the names *Ulcus Syriacum* and *Malum Egypticum*. Perhaps the earliest modern treatise upon the disease was that by Hecker, descriptive of the epidemic which prevailed in Holland in 1337. In 1517 diphtheria of a malignant type raged in Switzerland, along the Rhine, and in the Netherlands; in 1557 it was epidemic in France, Germany, Holland, and Spain. In 1659 it had reached the New England States in America. In 1765 a Scotch physician, Francis Home, endeavored to establish the fact that the . . . disease now called diphtheria was different from croup. In 1771 Dr. Samuel Bard, of New York, opposed Home, in a controversy, publishing very important and accurate observations regarding the disease. The term "putrid sore throat," given to the disease by Dr. John Fothergill, of London, in 1745, remained the accepted name in English-speaking countries until, in 1821, Bretonneau, of Paris, published his admirable and extensive observations upon the disease and gave it its present name. Little advance was made in the knowledge of diphtheria after Bretonneau's treatises were put forth until the microorganism of the disease was isolated.

**Mortality.** The control of diphtheria, which has been epidemic in America since 1857, is . . . the early treatment of the disease . . . antitoxin, together with systematic isolation of cases. While occasional clinicians of experience and ability are found who actively antagonize the theory of, and deny the good results from, the use of antitoxin, the great and overwhelming mass of evidence in its favor continues to increase year by year. The diphtheria committee of the Clinical Society of London published in its report for 1898 the following results of inquiry into 633 . . . cases of diphtheria: The total mortality in . . . cases was 19.5 per cent, as opposed to 29.6 per cent in the nonantitoxin control series, compiled before the introduction of antitoxin. In the tracheotomy cases the mortality amounted to 36 per cent, as opposed to 71.6 per cent in the nonantitoxin series. Buchwald, of Munich, reported 57.72 per cent of deaths in cases treated without

antitoxin, 28.93 per cent of those treated with antitoxin. Krönlein, of Zurich, reported to the Congress of German Surgeons in 1898 upon 1773 cases of diphtheria observed in the clinical hospitals of the University from 1881 to 1897. The mortality in the preantitoxin period was 39.9 per cent, against 12.5 per cent in the antitoxin period. In the operation cases (including both tracheotomy and intubation cases), the mortality was 66.1 per cent under the old régime, and 35.6 per cent with antitoxin. In the cases upon which no operation was done the mortality in the preantitoxin period was 14.2 per cent, against 5.6 per cent under antitoxin. The mortality at the South Department, Boston, a large infectious hospital, from 1888 to 1894, the year of the introduction of antitoxin, was 43.2 per cent. From 1895 to 1904 inclusive, it was 11.48 per cent. For the year 1912 it was 7.6 per cent, including laryngeal and moribund cases. The greatest reduction was in the very severe cases where massive doses of antitoxin were administered. Both nasal and laryngeal diphtheria require large doses of antitoxin. Dr. H. M. Biggs concludes, from extensive experience and many researches made as pathologist of the Health Department of New York City, that, "since the introduction of antitoxin treatment, the mortality of diphtheria is reduced one-half; its course is shorter and milder; an injection made within the first two days of the disease reduces the mortality to 5 per cent, and the earlier the injection is made the better is the result. Small quantities of concentrated serum are tolerated by very young infants. If antitoxin is not a specific, it is certainly the best remedy in our possession against diphtheria. The genuine (i.e., un-complicated bacillary) cases are more amenable to its favorable influence than mixed infections. It has no secondary effects on the heart, kidneys, or nerves. Heart failure and paralysis, whenever observed, are caused by diphtheria, not by antitoxin."

**Carriers.** Diphtheria is not an air- or dust-borne disease, but is spread by direct contact with the infected secretions of the nose and throat. Attendants upon those sick with the malady should avoid letting the patient cough in their faces, should disinfect all fresh secretions, and should be "immunized" by small doses of antitoxin. The greatest problem is the carrier—an individual who has clinically recovered, but who continues to harbor the bacilli, often of a virulent character, in the nasal passages or throat. Antitoxin has very little effect on such cases, and cultures taken from them continue to prove "positive" for . . . . . Various expedients have been tried to sterilize carriers. Painting the tonsils with iodine preparations, spraying with staphylococcus cultures to "override" the Klebs-Löffler organism, the injection of vaccines, and even the removal of the offending tissues (such as tonsils and adenoids) have been practiced with greater or less success. It has been shown that patients with abnormal upper-air passages are much more likely to harbor pathogenic germs than those possessing normal noses and throats.

**Bacteriology and Pathology.** The bacillus which causes diphtheria was discovered in 1883 by Klebs, and in 1884 Löffler published the results of his careful study of the bacillus. Roux and Yersin added proof to the dependence of diphtheria upon this bacillus, and the names of the first discoverers have been given to the

causative . . . . . The bacillus is from 2.5 to 3 micromillimeters long and about one-fifth as wide. It varies in shape, being straight or slightly curved, with rounded, clubbed, or, more rarely, pointed extremities. It is aerobic, nonmotile, and nonliquefying, and grows best in a slightly alkaline medium. One of its most marked peculiarities is that, when treated with Löffler's alkaline methylene-blue solution, it takes an irregular stain, being darker in some parts than in others. This peculiarity is extremely valuable in identifying the organism. Artificially the bacillus may be cultivated on bouillon, agar, or blood serum, but it grows most rapidly and luxuriantly on glucose broth serum (Löffler's blood-serum mixture) at about body heat. Advantage is taken of this in determining its presence in doubtful cases. Thus, if a scraping from the membrane be rubbed over the surface with blood serum, and the tube containing the same be placed in an incubator for from 12 to 16 hours, the Löffler bacillus, if present, so outstrips most other bacilli in growth that a specimen examined with the microscope shows an almost pure culture of diphtheria bacilli. The bacillus does not develop spores (see BACTERIA), can live for months in the dried condition, but is killed by exposure for 10 minutes to 58° C., moist heat. Various other bacteria are often associated with the Löffler bacillus in diphtheria. Of these, the most common and most important is the *Streptococcus pyogenes*. This organism is probably responsible for the suppuration of the glands, for the broncho-pneumonia, and the general infection, which sometimes occur during the course of a diphtheria.

To Weigert, Wagner, and Oertel we are indebted for much of our knowledge of the minute . . . . . which take place in the formation of the membranes. The diphtheria bacilli or their poisons first induce necrosis of the more superficial cells. This is followed by a more extensive . . . . . necrosis, with exudation, the whole forming the well-known false membrane. This membrane is most common on the mucous membrane of the tonsils and adjacent parts of the pharynx, but may extend to or involve any portion of the mucous membrane of the throat, mouth, or nose. Among the most fatal forms of diphtheria are those in which extensive membranous formation takes place in the nose or in the larynx, the latter sometimes called "membranous croup." (See CROUP.) Diphtheritic membranes are occasionally found on the conjunctiva, in the external auditory canal, the mucous membrane of the anus and genitals, and on wounds of the skin. Of lesions in other organs, broncho-pneumonia is not uncommon, and some cases are accompanied by acute parenchymatous nephritis. Of later effects, the most common and important is paralysis, a lesion of the nature of a multiple neuritis, due to the poison of the disease. The changes in the nerves are of a degenerative character, and quite similar to those found in neuritis (q.v.) from alcohol or other poisons.

**Toxin and Antitoxin.** The . . . . . has been isolated by Roux, . . . . . Fraenkel, and others, by filtration of cultures of the living bacilli through porous porcelain. It appears to be analogous to the poisons of certain venomous serpents. Behring (q.v.) announced his discovery of diphtheria antitoxin in 1890. He, Fraenkel, Wernicke, Aronson, Roux,

and others succeeded in rendering animals immune to diphtheria by the use of inoculations of virulent or somewhat attenuated cultures of diphtheria toxin. Behring, in conjunction with others, showed that the blood of immune animals contains a substance which neutralizes the diphtheria toxin. The blood serum of persons who have recovered from diphtheria has also been found to possess this protective property, which it acquires about a week after the beginning of the disease and loses again in a few months. To lengthen the term of immunity, Behring, in 1913, introduced a vaccine consisting of a mixture of diphtheria toxin and antitoxin. To obtain antitoxin for therapeutic purposes, strong toxin obtained from virulent cultures of the Klebs-Löffler bacillus is injected into the bodies of young, healthy horses. At the end of two months, during which time increasing doses of the toxin have been given, blood is drawn from the horses and tested for antitoxin. That having sufficiently strong antitoxin is retained and the process of inoculating and of . . . serum is repeated for years, all . . . months of each year as an interval of freedom from inoculations. The antitoxin serum is used hypodermically as soon as a diagnosis of diphtheria has been made, in dosage of from 600 to 2000 units, a unit being equivalent to 1 cubic centimeter of "normal serum"; i.e., of blood serum of an immunized animal, which was made so efficacious that 0.1 cubic centimeter antagonizes 10 times the minimum of diphtheria poison fatal to a guinea pig weighing 300 grams, or about 10 ounces. Consult Löffler (et al.), *The . . . of Diphtheria* (C. . . 1913), . . . *Diphtheria in Practice* (London, 1908). See ANTITOXIN; BACTERIA; IMMUNITY; SERUM THERAPY, and the various authorities referred to thereunder.

**DIPHTHERIA (IN FOWLS).** See ROUP.

**DIPHTHERIA (IN PIGS).** See SWINE PLAGUE.

**DIPH'THONG** (Lat. *diphthongus*, Gk. διφθόγγος, *diphthongos*, diphthong, from δι-, *di-*, double + φθόγγος, *phthongos*, sound, from φθέγγεσθαι, *phthengesthai*, to utter). A term used to denote two vowel sounds following one another so closely as to form but one syllable, as in *out*. In this combination the sound is really composed of an *a* as heard in *father* and a *u* as heard in *put*. The . . . ish has little or no relation . . . in this matter. In many syllables written with two vowels, only one sound is heard, as in *bread*. This is often called an "imp . . . contradistinction with the . . . as indicated in the word *out*. The . . . letters, again, often represent a . . . sound; thus, the long sound of *i*, as it is called, is really composed of the sound of *a* as heard in *father* and that of *e* in *me*; and *tune* is pronounced as if written *teun*, or rather *tyun*. In such words as *bread*, *field*, the vowels, which are now monophthongs, were at one time real diphthongs and are still so pronounced in some parts of England; on the other hand, many diphthongs in modern English are developed from original simple vowel sounds, . . . the *ou* in *mouse* is derived . . . old English *mūs*.

**DIPLOCOC'CUS.** See BACTERIA.

**DIPLODOCUS** (Neo-Lat., from Gk. διπλός, *diploos*, double + δόκος, *dokos*, beam). A gigantic fossil reptile of the order Dinosauria, sub-

order Sauropoda, found in the Jurassic rocks of western North America. Its body was long and low, its head remarkably small, its neck very long, trunk short and deep, and the tail was very long and quite thick at the base. The legs were strongly built and of almost equal length, indicating quadrupedal locomotion, and the feet were armed with heavy claws. The skull was high and laterally compressed posteriorly, with a long sloping face, and with large orbits situated far back on the sides. The jaws had weak, slender, spreading teeth only in their anterior portions, all the premolars and molars being absent. The vertebrae of *Diplodocus* are of great interest because of the elaborate systems of plates and buttresses that give support to the vertebral processes and thus lend great strength without much increase of weight. The animal appears to have been herbivorous and was probably aquatic, living in the extensive marshes and swamps of the Jurassic seas and lowlands that probably resembled those of the modern Amazon and Congo basins. Some figures, based upon the skeleton mounted in the Carnegie Museum at . . . express more clearly the immense . . . of this ancient reptile. The total length, from tip of nose to tip of tail, was about 60 feet, and its height was nearly 12 feet. The head was 2 feet long, only one-thirtieth of the length of the body, and the neck 20 feet in length. The trunk, from the point of the shoulder blade to the middle of the sacrum, measured 13 feet and had a depth of 7 to 8 feet, and the tail was at least 25 feet long. The animal is estimated to have weighed, when alive, about 20 tons and to have required a daily meal of at least 500 pounds of vegetable food such as the twigs, leaves, and succulent stems of plants that grew in the waters of its habitat. Consult Hatcher, "Diplodocus, Marsh: Its Osteology, Taxonomy, and Probable Habits," *Memoirs of the Carnegie Museum*, vol. i, No. 1 (Pittsburg, 1901); Lucas, *Animals of the Past* (New York, 1901). See DINOSAURIA.

**DIPLODUS.** See PLEURACANTHUS.

**DIPLOGRAPTUS** (Neo-Lat., from Gk. διπλός, *diploos*, double + γράφω, *grapho*, I write). A genus of axonophorous graptolites with component bushlike colonies, the stipes of which consist of double rows of single tubular cells. The genus contains about 100 species, among them the most common graptolites of the Ordovician in Europe, America, and Australia. The best-known species are *Diplograptus foliaceus* and *Diplograptus quadrimucronatus*; the latter of world-wide distribution. See GRAPTOLITE.

**DIPLOMA** (Lat., from Gk. δίπλωμα, folded paper, letter of recommendation, from διπλός, *diploos*, double). A term used by the ancients especially to indicate letters of license received from the government. It originated in the custom of writing such documents on two tablets of wax which were doubled or on writing material which was folded. Subsequently the term was applied to all old Imperial and ecclesiastical acts and grants, public treaties, deeds, letters, wills, and all similar instruments that were drawn up in a formal manner and marked with a seal or other peculiarities for identification. The term is now restricted, for the most part, to instruments given by universities, colleges, and other learned societies in proof of the holder's having attained a certain degree, or to the licenses held by professional persons as an essential qualification to the practice of their art. While the old



legal significance of such diplomas has largely lost its force, they are yet required by the public as a protection from imposture and as an indication of some qualification in the art professed. In the United States there is a decided tendency towards bringing all such diploma-conferring bodies under the supervision and control of the State, thus putting them upon much the same plane that they occupy in continental Europe. See CHARTER; COLLEGES, AMERICAN; DEGREE; PALEOGRAPHY; UNIVERSITY.

**DIPLOMACY.** In the wider sense, the art or science of foreign politics. The term is, however, more commonly employed in the more restricted meaning of the art of managing the intercourse and adjusting the relations of states to one another by negotiation. Used in this sense, the word is of modern origin, dating back only to the latter part of the eighteenth century. The art and the processes connoted by the term, however, are as old as international relations and cover the whole field of such relations, whether strictly political or not. The principal objects of diplomacy have always been the same—to preserve the independence and safeguard the security of the state, or to secure some coveted political advantage over other states. Subsidiary to these principal objects have been the more immediate purposes of preserving certain political arrangements—such as the European “balance of power”—intended to prevent the aggrandizement of certain states at the expense of others, the prevention of general wars, and the securing of commercial advantages to the subjects of trading nations. Under settled political conditions, such as now exist in Europe and in North America, the commercial purposes of diplomacy tend to become more prominent than those of a purely political character, though the latter never lose their supreme importance and are never far in the background of international intercourse.

The methods of diplomatic action vary according to the magnitude of the interests involved and the nature of the emergency which calls them into play. For the settlement of questions vitally affecting several states, or such as involve the peace of a continent, or the general policy of the great powers of Christendom, a general congress or international conference may be summoned. Of this character was the Congress of Westphalia, held in 1648 to settle the issues involved in the Thirty Years' War; the Congress of Vienna (1814-15), by which the problems arising out of the Napoleonic wars were adjusted; The Hague Conferences (1899, 1907), for the promotion of the peaceful settlement of international differences among all civilized states; and the Conference of Algieras (1906), for the settling of relations between European powers and Morocco.

Questions of less general importance, arising among two or more states, are more frequently settled by formal treaties or by the regular diplomatic channels of the states affected, though these may also be considered and the conflicting claims of the parties adjusted by joint commissions appointed for the purpose. Where these claims cannot be so adjusted by negotiation, resort may be had to a permanent tribunal of arbitration, like that established as the result of the first Hague Conference above referred to, or to arbitrators agreed upon by the parties to the controversy. Matters of less importance, not requiring formal

adjudication or the solemn sanction of a treaty, are commonly dealt with in informal conferences between the foreign offices of the states concerned, and these result in friendly understandings as to the policy to be pursued by them.

The management of the foreign intercourse of a nation is one of the chief functions of the executive head of the state. Formerly it was largely performed by the ruler in person, but it has in modern times passed into the hands of a class of officials known as diplomatic agents, though the most important of these, as ambassadors, are invested with an extraordinary degree of dignity, from the fact that they are supposed to represent the person of the sovereign, and not merely the foreign office of the state by which they are accredited. Under modern conditions the usual instruments of diplomacy are: (1) the principal secretaries of state for foreign affairs; (2) regular diplomatic agents of various grades, ranging from ambassadors to *chargés d'affaires*; (3) occasional embassies or agents of diplomatic intercourse appointed for the accomplishment of a particular purpose. See DIPLOMATIC AGENTS.

Prior to the fifteenth century diplomatic intercourse was conducted almost entirely by ambassadors and other agents of the last-named class, and was as ineffective as its irregularity and lack of knowledge would lead us to expect. But with the establishment of resident legations in that century the practice of diplomacy was raised to a fine art, which rapidly assumed commanding importance in European politics. At a period when international relations were based on personal and dynastic interests, and when statecraft was another name for intrigue, the rôle of the ambassador was second in importance only to that of the sovereign. Success in diplomacy turned largely upon the personal qualities of the ambassador, upon smooth and engaging manners, cunning and astuteness, and was thus a matter of personal influence. Being beyond the reach of instructions, he occupied a position of great independence and power. There was no diplomatic profession, but the great posts in the service were sought after by the greatest persons in church and state. The institution by all the Great Powers of a trained diplomatic service in the last century, and the astonishing improvement in methods of communication, especially in the use of the telegraph, have greatly impaired the power and importance of ambassadors and have tended more and more to reduce them to the position of mere intermediaries, acting under instructions from the governments which they represent.

It may be doubted whether diplomacy can fairly be held responsible for the dishonorable methods with which the term has come to be associated. If it has at times been characterized by intrigue and deception, by the absence of large views and generous motives, by selfishness, and a disposition to sacrifice the interests of the weaker to the stronger, it has in these respects only too accurately reflected the statesmanship of its time. And that statesmanship was for centuries based on the perfectly just supposition that “Europe was always in a state of war, overt or latent.” The gradual substitution of national for personal and dynastic interests, which the last century has witnessed, has at once given a more pacific character to international relations and a more straightforward and business-like tone to our diplomacy.

Not that suspicion has entirely disappeared from the one, or deception from the other, but they have become the exception and not the rule.

The international relations of states with which diplomacy has to do are only those of a pacific character. With the outbreak of war diplomatic relations come to an end. The suspension of diplomatic intercourse is usually a preliminary to a declaration of war, though it is sometimes employed as a mild means of coercion of a weak state by a more powerful one. In such a case it may be regarded as a strong expression of displeasure, which may, if reparation be unduly delayed, result in the use of force.

The usage of the last 300 years has resulted in the general adoption of French as the language of diplomatic intercourse in Europe. The recent tendency has been to confine this to oral intercourse, written instructions and other diplomatic dispatches being usually couched in the language of the government employing and receiving them.

The history of diplomacy is one of the most interesting and important chapters in the political history of nations. Its sources are to be found in treaties, in the correspondence of ministers of state and ambassadors, contained in the published and secret archives of states, and in the diaries and private correspondence of public officials and courtiers. For a further discussion, see INTERNATIONAL LAW, and the authorities there referred to; also Moore, *A Hundred Years of American Diplomacy* (New York, 1900); id., *History and Digest of International Arbitrations* (New York, 1905); id., *The Old Diplomacy and the New* (New York, 1905); id., *American Diplomacy* (New York, 1905); Hill, *History of Diplomacy in the International Development of Europe* (6 vols., ib., 1905-06); Foster, *Practice of Diplomacy as Illustrated in the Foreign Relations of the United States* (Boston, 1906); Paullin, *Diplomatic Negotiations of American Naval Officers, 1778-1883* (Baltimore, 1912).

**DIPLOMACY.** A play adapted from Sardou's *Dora*, by Bolton and Savile Rowe, and produced in 1878.

**DIPLOMATIC AGENTS.** In the widest sense, all the officers to whom the intercourse of the state with foreign powers is committed. As thus employed, the expression would include the Foreign Minister, or Secretary of State for Foreign Affairs, and, in the United States, the Senate in the exercise of its constitutional function of approving treaties with foreign states, as well as the regular and occasional representatives of the government abroad. More properly, however, it has reference only to the latter class of officials, who, under instructions from the home government, carry on its intercourse with the Powers to which they are accredited. Attention has been called in the article on DIPLOMACY to the fact that for many centuries the diplomatic intercourse of states was carried on by occasional embassies, appointed for a particular purpose, and that it was not until the fifteenth century that permanent and continuous diplomatic relations were instituted by the establishment of resident embassies. By far the greater part of the international intercourse of the modern world is conducted through these regular diplomatic channels, though occasional embassies are still employed for special occasions, principally of a ceremonial character, and the Foreign

Office, or Department of State, of one government may, on occasion, communicate its views directly, by circular or otherwise, to the corresponding office of foreign states.

The transformation of diplomacy in the last century, from the art of applying personal influence in the management of men to the more prosaic and business-like managing the business of the state with foreign nations, has necessitated a corresponding change in the organization and character of the diplomatic service. The personal qualities of shrewdness, a talent for intrigue, and smoothness of address, on which the old diplomacy was based, declined in importance, and made way for the knowledge of international law, of history, of the laws and conditions of trade, of men and affairs, which the new diplomacy required. Accordingly the management of diplomatic intercourse has in Europe generally passed from the men of exceptional gifts or exceptional influence, selected at random for the service, to a professional class of trained diplomatic servants. The comparative isolation of the United States hitherto, and the simplicity of her foreign relations, have delayed the adoption of this reform in her diplomatic service, but the new conditions resulting from the war with Spain and her recent extraordinary commercial expansion indicate that a similar change in the character and organization of her diplomatic service cannot be much longer delayed.

Formerly the term "ambassador" was applied to all accredited diplomatic agents, and it is sometimes still employed, though with "minister," as a general term to describe such agents of whatever rank. But the title is now strictly appropriate for only one, and that the highest, class of diplomatic representatives. The process of classification began before the close of the seventeenth century, but did not receive international recognition until the beginning of the last century. In 1815 the eight principal Powers represented at the Congress of Vienna agreed upon a gradation of diplomatic agents, who were thenceforth to rank as follows: (1) ambassadors, legates, and papal nuncios; (2) envoys, ministers, and others accredited to the sovereign; (3) *chargés d'affaires* accredited to the Department of Foreign Affairs. At the Congress of Aix-la-Chapelle a further distinction was made between ministers plenipotentiary, who were accorded the second place, and ministers resident, who became "an intermediate class between ministers of the second order and *chargés d'affaires*." As the rank of a foreign minister has never to do with his power or with the immunities afforded him for transacting diplomatic business or with the immunities enjoyed by him, but is a mere matter of precedence and the ceremony of courts, the United States long refused to recognize the classification of the European Powers and accredited all of its principal diplomatic agents as ministers plenipotentiary, i.e., ministers of full power and authority. In 1893, however, the President was authorized by Act of Congress to appoint ambassadors of full rank and of equal grade and dignity with those which should be accredited by foreign Powers to this country. In accordance with this act the United States is now represented by ambassadors at the courts of Great Britain, Germany, Italy, Austria, Russia, Japan, Spain, and the republics of France, Mexico, Brazil, Argentina, and Chile.



In addition to these regular diplomatic representatives, a state may also employ agents of an irregular and inferior sort who have a certain qualified diplomatic status, as officers in command of armed forces in foreign territory, commanders of ships of war, secret agents sent on diplomatic errands, commissioners for special objects, bearers of dispatches, and, under exceptional circumstances, consuls. All of these enjoy some of the privileges and immunities which attach to the exercise of the diplomatic office.

While it is not in general open to a state to refuse to receive a diplomatic agent from another power, it may, for special reasons, object to receive a particular individual in a diplomatic capacity. If, however, the grounds for such objection do not commend themselves to the state by whom the minister was accredited, it may, as a mark of its disapproval, leave the post vacant for a considerable time. An instance of this was the rejection in 1885 of a minister appointed by President Cleveland by the Italian and Austrian governments in succession. The grounds of the objection of Italy being satisfactory, another appointment was promptly made, but, the Austrian objection being regarded as frivolous and unreasonable, the legation at Vienna was left in the hands of a chargé d'affaires. So, too, a state may, without giving international offense, request the withdrawal of a foreign minister who has rendered himself obnoxious to the government to which he is accredited, or may even in a serious case peremptorily dismiss him. This was done in the case of Lord Sackville, the British Minister to the United States, who, on the eve of the presidential election of 1888, in a private letter incautiously expressed himself on the question of the probable relations of the government with Great Britain in the event of President Cleveland's reelection. This diplomatic indiscretion, occurring in the heat of a presidential campaign, was treated by the American government as an open and intentional affront, and the offending minister dismissed without waiting for his recall by his government. Obviously the right is one to be exercised with caution, in order to avoid giving offense to the state by whom the disgraced minister was accredited.

The distinction of the ambassadorial office, as the direct representative of a sovereign power, and the importance of the duties intrusted to it have combined to invest it with a peculiar sanctity. This has, in modern times, taken on the form of a privileged status attended with certain immunities, which a foreign minister enjoys in the country to which he is accredited. These may be briefly enumerated as follows: (1) exemption of the minister from the local jurisdiction, both civil and criminal; (2) inviolability of his house, his papers, and goods from search and seizure; (3) exemption of his personal effects from imposts and taxation; (4) liberty of worship for himself and the members of his family and suite; (5) a qualified exemption of his family and train from the local jurisdiction. These immunities are generally referred to the principle of extraterritoriality, the domestic jurisdiction of the minister being supposed, by a legal fiction, to go with him and to exclude the local jurisdiction of the state to which he is accredited. (See *ASYLUM*; *EXTRATERRITORIALITY*.) But in its modern form the doctrine is more properly ex-

plained on principles of convenience and international comity, the independence of the minister and the inviolability of his person, his family, and property being essential to the due performance of the high and important functions with which he is invested. The subject is fully treated in ancient and modern treatises on international law (q.v.). Consult: Hall, *Treatise on International Law* (4th ed., London, 1895); Woolsey, *Introduction to International Law* (6th ed., New York, 1891); Moore, *Digest of the International Law of the United States* (Washington, 1903).

**DIPLOMATICS** (from Lat. *diploma*, diploma). The science of ancient writings. The term is less used than the more convenient and descriptive term "paleography" (q.v.).

**DIPLOPIA**. See SIGHT, DEFECTS OF.

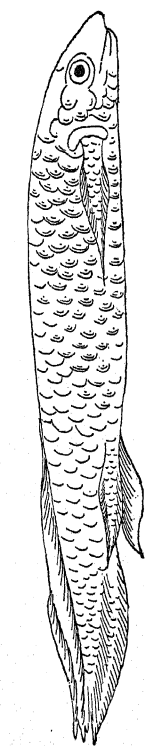
**DIPLOPODA**. See CHILOGNATHIA.

**DIPNOI** (Neo-Lat. nom. pl., from Gk. *di-*, double + *pnēin*, *pnēin*, to breathe, referring to their breathing through the gills and the lungs). The lungfishes, a group of fishes, by some zoölogists regarded as forming an entirely separate class of vertebrates. They were more numerous in past ages than now, when their only living representatives are the genera *Ceratodus* (see *BARRAMUNDA*), *Protopterus*, and *Lepidosiren* (see *MUDFISH*). Their chief peculiarity is in the organs of respiration, since, in addition to piscine gills, they have either one or two lungs proper to breathing air. They have bony scales, but the skeleton is cartilaginous, and thus described by Parker and Haswell: "The notochord is persistent, and the cranium [see *PLATE*] consists of a mass of cartilage with little ossification, but with the addition of a number of membrane bones, the skull is *auto-stylic*, the lower jaw articulating with a palatoquadrate process (*pal*), corresponding to the palatoquadrate of the dogfish, but immovably fixed to the side of the skull. There are four or five cartilaginous branchial arches. The gills are covered over by an operculum. The structure of the paired fins is on a totally different plan from that of any other living fish. The fin, pectoral or pelvic, as the case may be, is leaflike, or very long and narrow, and the skeleton consists of a central axis in the form of a slender, tapering, jointed rod of cartilage, with a row of smaller jointed rods of cartilage on either side of it. This form of fin skeleton, which occurs in certain groups of fossil fishes, as well as in Dipnoi, has been termed the 'fishbone'."

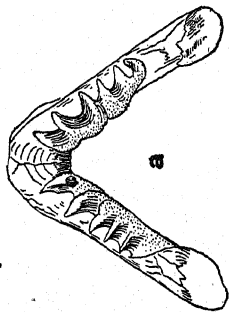
In respect to the structure of the sort parts it may be noted that a cloaca is present, and the intestine contains a spiral valve; the heart is more complicated and highly developed than in ordinary fishes, and a pulmonary artery and vein exist. The special interest in this group arises from the belief that it anciently gave rise to the class of amphibians. Consult: Cope, *Origin of the Fittest* (New York, 1886); id., *Batrachia of North America* (New York, 1889); Dean, *Fishes, Living and Fossil* (New York, 1895); Gadow, *Amphibia* (London, 1901); Lydekker, Cunningham, Boulenger, and Thomson, *Reptiles, Amphibia, and Fishes* (ib., 1912). See *MUDFISH*; *STEGOCEPHALIA*; and *PLATE OF DIPNOI AND CHIMAERA*.

**DIPNUS AND SCYLLIS** (Lat., from Gk. *Δίπνος*, *Dipnōnos*, and *Σκύλλης*, *Scyllis*). Early Greek statuariés, whose names are always associated. According to Pliny the Elder, they

# DIPNOI AND CHIMÆRA



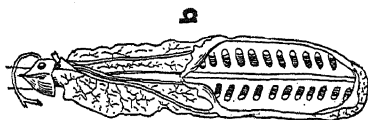
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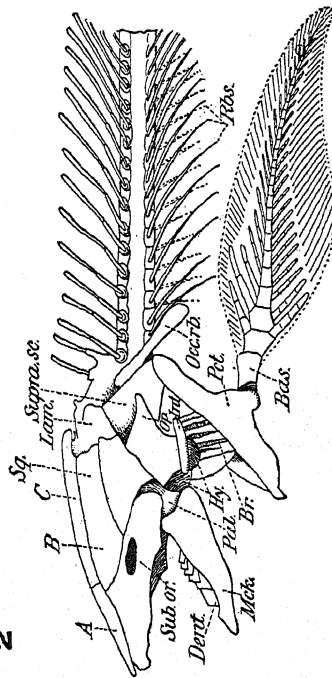


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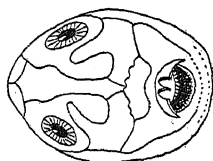
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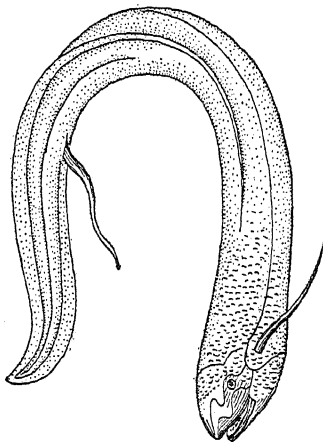
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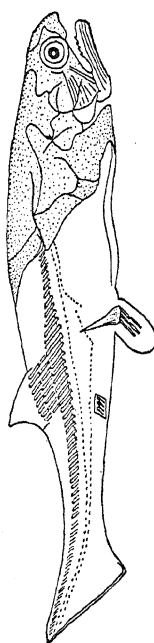
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b



5



1. BARRAMUNDA (*Ceratodus forsteri*): a, jaw and teeth; b, a lung, laid open; c, lung cell (enlarged).
2. DIPNOAN SKELETON. (See article Dipnoi).
3. MUDFISH (*Lepidosiren*): a, mouth and teeth; b, a scale (enlarged).
4. CHIMÆRA: a, face; b, under side of head. (See article Chimaera).
5. BERRYBONE FISH (*Coccoosteus declipens*).



were born in Crete about 580 B.C. Pausanias, in his *Ἑλλάδος Περιήγησις*, or *Itinerary of Greece*, states that they were pupils of (the mythical) Dædalus (q.v.). At Sicyon they executed statues of the gods, intended apparently for ornament in architecture rather than for devotional uses. Many works by them existed also at Ambracia, Argolis, and Cleonæ. A group of the Dioscuri and their sons in ebony and ivory at Argolis is of particular interest, as involving gold and ivory overlaying in statuette art. This method reached its perfection in the chryselephantine masterpieces of Phidias. Consult E. A. Gardner, *A Handbook of Greek Sculpture* (New York, 1911).

**DIP OF THE HORIZON.** See DEPRESSION.

**DIP OF THE MAGNETIC NEEDLE.** The angle which a magnetic needle makes with the horizon, or horizontal line, if the needle is so mounted as to swing freely about a horizontal axis and in a vertical plane passing through the magnetic meridian (direction pointed out by the compass). At the magnetic pole the needle stands vertical; at the magnetic equator it is horizontal. *Dip* has periodic variations, but of less relative magnitude than those of the magnetic declination. Since the year 1700 the dip at London has changed about seven degrees, and the daily inequalities do not ordinarily exceed two or three minutes. See TERRESTRIAL MAGNETISM; INCLINATION; COMPASS; DIP CIRCLE.

**DIPO'LIA**, or **DI'PO'LIA** (Lat., from Gk. τὰ Διπόλια, Διπόλια, Διπόλεια, from Διί, *Dii*, to Zeus + πολίεύς, *polieus*, guardian of the city, from πόλις, *polis*, city). An ancient Athenian festival celebrated annually on the fourteenth day of the month Scirophorion (June to July) to Zeus Polieus (Zeus Πολιεύς), the protector of the city. It was called *Buphonia* (q.v.) from the sacrifice of an ox, which was the principal feature of the celebration. Grain and sacred cakes were laid upon the altar of Zeus on the Acropolis. When the ox, brought before the altar, began to eat the grain, he was felled with an axe by the priest, who at once fled, throwing away the axe. The priest and the axe were subsequently arraigned in the Prytaneum and the axe was condemned and thrown over the borders of Attica. The whole ceremony seems to have originated at a time when the plow-ox was accounted sacred, so that even for the sacrifice of the ox to the gods atonement must be made. Consult Mommsen, *Feste der Stadt Athen* (Leipzig, 1898).

**DIPPEL**, dip'pel, ANDREAS (1866- ). A German singer, born in Cassel. He studied music in Berlin, Milan, and Vienna, and made his first appearance in 1887 in Bremen as Pilot in *The Flying Dutchman*. Afterward he sang in opera in London, Breslau, Vienna, and Bayreuth and in 1890-92 and 1898-1901 in the United States. In 1902-03 he made a concert tour in the United States, and in 1904-06 he again sang in opera in this country. From 1908 to 1910 he was joint director with Gatti-Casazza of the Metropolitan Opera House. In 1910 he organized the Chicago Opera Company, of which he was director till 1913. In 1914 he appeared as impresario of an excellent comic opera company, producing the better class of light opera and operettas.

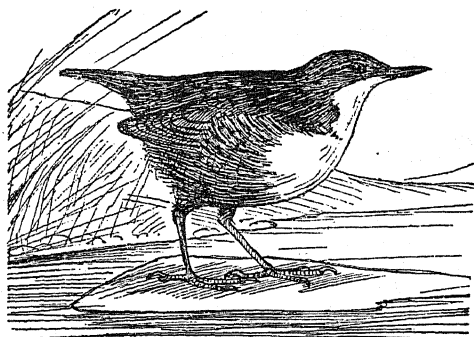
**DIPPEL**, JOHANN KONRAD (1673-1734). A German religious enthusiast and alchemist. He was born near Darmstadt, Aug. 10, 1673, studied at Giessen, lectured on alchemy in

Strassburg, but was expelled for alleged disorderly conduct, and henceforth led a wandering life. In 1697 and 1698 he published works attacking the Lutheran theology. From 1719 to 1725 he was imprisoned in the Danish fortress at Bornholm for his incautious remarks upon the Danish government, then went to Sweden, but thence he was banished through the influence of the clergy. He died at Berleburg, April 25, 1734. He was the discoverer of Dippel's oil and Berlin blue. He wrote several works under the pseudonym Christianus Democritus. For his *Life*, consult W. Bender (Bonn, 1882).

**DIPPEL'S ANIMAL OIL** (first prepared by J. K. Dippel in 1711). One of the products of the destructive distillation of bones. In the crude state it forms a thick viscid oil of a brown color and a very disagreeable odor, but on redistillation it may be obtained limpid and colorless. When taken internally in moderate doses, it acts as an antispasmodic and stimulates the vascular and nervous systems, but it is no longer used in medicine.

**DIP'PER.** The common American name for the constellation Ursa Major (q.v.).

**DIPPER.** 1. A small, somewhat thrushlike bird of the family Cinclidae, having an almost straight, compressed, sharp-pointed bill; compact, waterproof plumage, and extraordi-



THE AMERICAN DIPPER.

nary habits. Dippers frequent clear, pebbly streams and lakes, feeding chiefly on mollusks and on aquatic insects and their larvæ, which they seek even under water, diving with great facility, and moving about for a short time at the bottom of the water. They carry their rather short tails elevated after the manner of wrens, which they also resemble in their frequent tipping of the body, a dipping of the head accompanied with an upward jerking of the tail. The common European dipper, water ouzel, or water crow (*Cinclus cinclus*, or *aquatius*), is a bird smaller than any of the British thrushes, of a generally dark-brown color, with throat and upper part of breast pure white. It is found chiefly in hilly or mountainous districts and is not gregarious. The dipper never fails to attract notice, as it sits upon some stone in the midst of or beside the stream, its white breast rendering it conspicuous as it repeats the movements from which it derives its name. It builds a very curious nest of interwoven moss, domed and with the entrance in the side, usually in some mossy bank close by a stream, and often near or under a cascade.

The eggs are pure white. The assertion that the dipper walks without apparent muscular effort at the bottom of the water is incorrect; its feet are not well formed for walking, and it scrambles about under water by help of its short wings, clinging and clambering about by means of its toes. The statement, also often made, that it eats the spawn of salmon and other fishes, in the belief of which it is much persecuted in Scotland, has proved erroneous. It feeds chiefly on the larvæ of aquatic insects. About 12 species of dipper are known, one of which (*Cinclus mexicanus*) is found in the mountains of western North America from Alaska to Mexico; this lacks the pure white under parts of the European species, but otherwise resembles it closely. Its habits have been eloquently described by Muir, in "The Humming-Bird of the Californian Waterfalls," an illustrated article in *Scribner's Monthly* (New York, 1878). Consult also Keyser, *Birds of the Rockies* (Chicago, 1902), and Dawson, *The Birds of Washington* (Seattle, 1909).

2. The bufflehead, or spirit duck. See **BUFFLEHEAD**.

**DIPPING NEEDLE.** See **DIP CIRCLE**.

**DIPROTODON** (Neo-Lat., from Gk. δι-, di-, double + πρῶτος, prōtos, first + ὀδών, Ionic for ὀδούς, odous, tooth). An extinct herbivorous marsupial, of the size of a rhinoceros, related to the wombats and phalangers, and found fossil in the Pleistocene deposits of Australia. The skull is heavy, about 3 feet in length, and has a peculiar dentition. There are no canine teeth; the inner pair of upper incisors are enlarged, elongated, and chisel-shaped, like those of rodents. The lower incisors, two in number, are likewise elongated to meet those of the upper jaw, and, like these, they grew from persistent pulps; i.e., they continued to grow from their roots as they were worn away at their crowns, after the fashion of the incisors of rodents. Another related but somewhat smaller genus, *Nototherium*, the remains of which are found with those of *Diprotodon*, has a very similar dentition. These two fossil genera are the giants among the marsupials. See **MARSUPIALIA**.

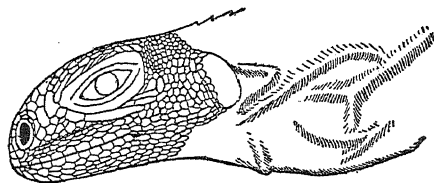
**DIP'SACUS.** See **TEASEL**.

**DIP'SAS** (Gk. διψάς, venomous snake, whose bite caused intense thirst, from διψα, dipsa, thirst). A genus, or family, of tropical serpents—the nocturnal tree snakes. See **TREE SNAKE**.

**DIP'SOMANIA** (Neo-Lat., from Gk. διψα, dipsa, thirst + μανία, mania, madness). A variety of periodic insanity. The patient manifests during certain periods an uncontrollable desire for alcoholic liquors and drinks to great excess, while during the intervals he abstains entirely from the use of liquor and seems mentally sound. The dipsomaniac is not a drunkard nor a "moderate drinker." He often experiences a positive aversion for the smell and taste of liquors, but when the imperative appetite seizes him, after a period of abstinence and of orderly, refined, and irreproachable conduct, he abandons himself to unrestrained indulgence. The intervals of sobriety are apt to become shorter and shorter. Dipsomania is a degenerative insanity, i.e., an insanity dependent upon an hereditary or acquired constitutional condition. The outlook for recovery is bad. Imbecility and dementia often result.

**DIP'SOSAURUS** (Neo-Lat., from Gk. διψα, dipsa, thirst + σαῦρος, sauros, lizard). A small, remarkable iguanid lizard (*Dipsosaurus dor-*

*salis*) of the Colorado and Mohave deserts and Lower California, known as the desert iguana, or keel-backed lizard. It has a very small head, a conspicuous ridge of keeled scales along the



HEAD OF DIP'SOSAURUS DORSALIS.

back, and a long, compressed tail. It is sand-colored, with obscure blotches on the sides, and the sides and legs streaked with brownish red. It is a strict vegetarian, feeding wholly on buds and flowers. Its nearest ally is the collared lizard (q.v.). The tail is very brittle and is often shaken off if the lizard is picked up by it.

**DIP'TERA** (Neo-Lat. nom. pl., from Gk. διπτερος, dipteros, two-winged, from δι-, di-, double + πτερόν, pteron, wing). An order of insects, the flies, characterized prominently by the development of only two wings, which are the front pair and membranous, while the posterior pair is represented by two club-shaped organs known as halteres, or "poisers," and by having mouth parts fitted only for sucking and piercing, but not for gnawing. Their metamorphosis is complete. See **FLY**.

**DIP'TERUS** (Neo-Lat., from Gk. διπτερος, dipteros, two-winged). A genus of fossil dipnoin fishes of the family Ctenodontidae, found in the Old Red Sandstone of the Scottish Devonian. The body is small, rather slender, tapering gradually towards the heterocercal tail, and is covered by circular enameled scales. The head is low and blunt anteriorly, and the skull bones are small and numerous. There are a pair of pectoral fins and two dorsal fins, situated posteriorly, opposite the pelvic and anal fins, and all of these have their bases covered for a considerable distance with the enameled scales of the body. For recent works on this group, consult Eastman, "Devonian Fishes of Iowa," in *Report of the Iowa Geological Survey*, XVIII (Iowa, 1908). See **LUNGFISH**.

**DIPTYCH**, dip'tik (Lat. diptycha, nom. pl., neuter, from Gk. διπρυχος, diptychos, folded double, from δι-, di-, double + πρυχή, ptychē, fold, from πτύσσειν, ptysssein, to fold). A double writing tablet, or two writing tablets which are joined by hinges. Herodotus speaks of such a tablet, made of wood and covered with wax. It was in the later Roman time, however, that they were most used; those which have been preserved belong chiefly to the period when classical was merging into mediæval life. The beautiful carving with which they are often covered on the outside, consequently, represents not unfrequently a combination of classical and of Christian subjects. Ivory and metal were sometimes employed in place of wood; but the construction was always the same, the wax with the writing being in the inside. Under the emperors diptychs were distinguished as consular and ecclesiastical. The former, which were presented by the consuls, prætors, and ædiles to their friends, and those officially connected with them, on their entrance into office, were inscribed with their names and bore their

portraits. They served also, often, as New Year's presents. The extant specimens range from 406 to 541 A.D. For an illustration, consult Smith, *A Dictionary of Greek and Roman Antiquities*, vol. i, p. 643 (3d ed., London, 1890). The ecclesiastical diptychs, on the other hand, are decorated with scenes from sacred history and were preserved in the churches as part of the sacred ornaments. Those that exist are of various sizes, rarely exceeding 8 by 4 inches. They contain lists of contributors, of deceased members of the community who deserved special recognition, of saints and benefactors, particularly of the bishops. These lists were long read aloud in the churches. See ΤΡΙΠΤΥΧΗ.

**DIPYLON GATE** (Gk. διπύλον, from δι-, di-, double + πύλη, pylē, gate), THE. The most important gate in ancient Athens, in the Themistoclean Wall, between the inner and the outer Ceramicus (q.v.). It consisted of two sets of double gates, separated by a court about 127 by 70 feet. From it the Sacred Way led to Eleusis (q.v.). The dead were buried near the gate, and in the vicinity a number of beautiful ancient tombs are in part preserved. Portions of its foundations and remains of the walls of Themistocles still exist. Consult E. A. Gardner, *Ancient Athens* (London, 1902), and Weller, *Athens and its Monuments* (New York, 1913).

**DİR**, dēr. An independent state of India, in the Northwest Province, 175 miles northwest of Srinagar (Map: India, B 1). It commands the route between Chitral and Peshawar. Pop. (est.), 100,000.

**DİRCE**, dēr'sé (Lat., from Gk. Διρκή, *Dirkē*). A famous fountain and stream at Thebes, named, according to Greek story, after Dirce, the wife of Lycus, King of Thebes. Dirce had sorely persecuted Antiope, who at last escaped to Mount Cithæron, where her twin sons, Amphion and Zethus, had been brought up by a herdsman in ignorance of their parentage. Here Dirce, while celebrating the rites of Dionysus, found her, and ordered Amphion and Zethus to bind her to the horns of a wild bull, that she might be dragged to death. They were about to execute the command, when by the aid of the herdsman they learned their relationship to Antiope and thereupon inflicted upon Dirce the punishment she had designed for their mother. See AMPHION.

**DİRCKS**, HENRY (1806-73). An English civil engineer and author, born in Liverpool. He began to lecture on chemistry and electricity in 1827. Afterward he became distinguished as a railway and mining engineer, in which capacity he made several inventions. The unique mechanical device known as "Pepper's Ghost" was invented by him, and described in the work entitled *The Ghost, as Produced in the Spectre-Drama, Popularly Illustrating the Marvellous Optical Illusions Obtained by the Apparatus Called the Dircksian Phantasmagoria* (1863). His other works include: *Jordan-Type, otherwise called Electrotpe* (1852); *Perpetuum Mobile* (1861); *Inventions and Inventors* (1867).

**DIRECT** (Lat. *directus*, straight, from *dirigere*, to direct, from *di-*, apart + *regere*, to guide), and **RETROGRADE** (OF. *retrograde*, Fr. *retrograde*, Lat. *retrogradus*, moving backward, from *retro*, backward + *gradi*, to go). In astronomy, the motion of a planet is said to be direct when the planet goes forward by its proper motion in the zodiac according to the succession or order of the signs (i.e., from

west to east), or when it appears to do so to an observer. On the other hand, it is said to be retrograde when it appears to go the contrary way.

**DIRECTOR**. A person chosen to act on a board of managers to control the affairs of a business corporation or joint-stock company. Officers acting in a similar capacity for eleemosynary corporations are usually, though not necessarily, known as trustees. The director is usually a stockholder of the corporation and elected to his position by vote of the stockholders, the length of time for which he may hold his office and the manner of his election being determined by the by-laws of the corporation.

The director is in a certain sense the agent of the corporation. He represents the corporation and not its stockholders, and, while not strictly a trustee, he acts in a fiduciary capacity, and his responsibility is not unlike that of a trustee. At common law the director is under no personal liability for the debts or obligations of the corporation. He is, however, liable to the stockholders in an action of tort for gross negligence or misfeasance in office resulting in loss to them. He is prohibited from using his position of trust for personal profit, and his contracts made with the corporation for that purpose may be set aside on application of a stockholder to the courts.

Generally speaking, the directors, acting as a board or through properly appointed agents, have authority to do any act in the line of the legitimate business of the corporation which the company may itself do under its charter; but they may not totally change that business nor dispose of what is essential to its existence or to the carrying out of its purposes without the consent of the stockholders. Yet in some jurisdictions they may by their act bind the corporation to do acts which are strictly ultra vires. See CORPORATION.

In practice, much of the business of the board of directors is transacted by a committee of its members, usually termed an executive committee, whose powers are defined by the by-laws of the corporation or by vote of the board of directors. In boards of bank directors in England a distinction is made between ordinary and extraordinary directors, the former conducting the business in its details, the latter having little to do with the actual business, and in reality being honorary officers who allow their names to be used to benefit the undertaking by the distinction attached to them from their personal or financial position. This practice is not common in the United States, though not unknown. The disposition of the profits of the corporation is, under most charters, left largely to the directors. Thus they may, if they choose, apply profits to the extension of facilities or purchase of new plant, or other improvements, rather than to dividends, in their discretion and without a vote of the stockholders.

Modern statutes have increased the liability of directors of corporations to an extent varying considerably in the different States of the Union. A provision sometimes made is one making directors personally liable for the debts of the corporation if they do not file annually with the Secretary of State a report upon the affairs and business of the corporation. Under the special English statutes known as the Joint Stock Companies Acts the duties and responsi-

bilities of directors are very clearly defined. It is provided that if the directors of a company declare a dividend when the company is known to them to be insolvent, or declare a dividend to pay which would to their knowledge make it insolvent, they shall be personally liable for the debts of the company to an amount equal to the dividend declared under such circumstances; in the United States the common law on this point generally prevails.

It is customary to pay directors a slight fee for their services, but this is usually insignificant in comparison with the interests involved; usually the motive of the director in taking the office is the prosperity of the concern as benefiting him in the position of a stockholder. See CORPORATION; and consult the authorities there referred to.

#### DIRECTOR OF PUBLIC PROSECUTIONS.

An office created by Act of Parliament in 1879 (the Prosecution of Offenses Act, 42 and 43 Vict., c. 22) to systematize and direct the prosecution of criminal and certain other public offenses in England. Originally an independent department of the crown, the office was in 1884 (47 and 48 Vict., c. 58) merged in that of the Solicitor to the Treasury, who now, subject to the Attorney-General, acts as public prosecutor. Prior to this legislation the prosecution of criminal offenses was a haphazard affair, being left to the enterprise of private complainants. The public prosecutor now exercises substantially the functions of the district attorney in the criminal administration of the United States.

**DIRECTORS, INTERLOCKING.** See INTERLOCKING DIRECTORATES; TRUSTS; RAILWAYS.

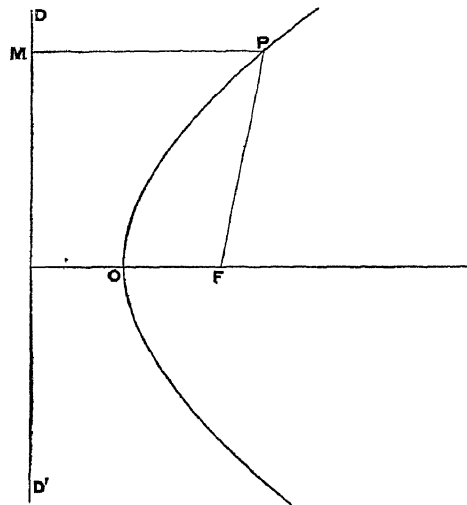
**DIRECTORY** (Fr. *directoire*, from Lat. *dirigere*, to direct). The name given to the executive government in France from Oct. 28, 1795, to Nov. 9, 1799. After the overthrow of the ultra-Jacobins the moderate Republicans promulgated a new constitution, that of the year III, which provided for a government of two councils. The Council of Five Hundred was to propose the laws, the Council of Ancients was to pass on them. As executive head, five members, chosen from both bodies, were to act. The first five directors chosen were Barras, Carnot, Rewbell, La Révellière-Lépeaux, and Letourneur. Each was to preside for three months at a time, and one had to retire every year. Though the foreign policy of the Directory was successful at first, the brilliant campaigns of Moreau in the North and Bonaparte in Italy resulting in the Treaty of Campo Formio, which isolated England and made possible Bonaparte's Eastern campaign, yet its essential weakness was later shown in the notorious "X. Y. Z." negotiation with the United States, and its defeat by the Second Coalition. Meanwhile its management of home affairs was corrupt and incompetent in the extreme. The members formed factions, and Barras, with his associates La Révellière and Rewbell, succeeded in ousting the other two directors, Carnot and Barthélemy, who had succeeded Letourneur, by the coup d'état of 18th Fructidor (Sept. 4, 1797). At the end of that year the Directory consisted of Barras, Ducos, Gohier, Moulins, and the Abbé Sieyès; but the last of these had begun to plot against the constitution, and the military disasters of 1799 furnished a pretext for its overthrow by the coup d'état of the 18th Brumaire (Nov. 9,

1799), which resulted in the establishment of the Consulate (q.v.), with Napoleon as First Consul. Consult: Granier de Cassagnac, *Histoire du Directoire* (3 vols., Paris, 1863); Barranté, *Histoire du Directoire* (3 vols., ib., 1855); Pierre, *La Terreur sous le Directoire* (ib., 1887); Sciout, *Le Directoire* (4 vols., ib., 1895-97); Sorel, *L'Europe et la révolution française* (8 vols., ib., 1910); Guyot, *Le Directoire et la paix de l'Europe* (ib., 1911). See FRANCE.

**DIRECTORY FOR THE PUBLIC WORSHIP OF GOD.** A code of regulations which governs public worship in the Church of Scotland and supplies the place of the Anglican Book of Common Prayer. It was compiled by the Westminster Assembly in 1644, by order of both houses of the English Parliament, and was adopted by the Church and the Parliament of Scotland in 1645. Many of its regulations are still adhered to by the Scottish Presbyterian church.

**DIRECT PRIMARIES.** See ELECTORAL REFORM; PRIMARY ELECTIONS.

**DIRECTRIX OF A CONIC.** A straight line perpendicular to the axis, by reference to which the nature of the conic may be defined. Assume an indefinite straight line as the directrix, and a point without the directrix as the focus; then, if a line is revolved about the focus, any point moving in the line will generate a curve, which will be a conic section (q.v.), provided there is a constant ratio between the distance from the moving point to the focus and the perpendicular distance from the point to the directrix. The curve is an ellipse, a parabola, or an hyperbola, according as the distance from any point of the curve to the focus is less than, equal to, or greater than the perpendicular distance from the point to the directrix. The constant ratio mentioned is often called the determining ratio of the conic. In the figure  $DD'$



represents the directrix of a parabola,  $F$  the focus,  $O$  the vertex, and  $P$  any point on the curve. According to the determining ratio,  $PM = PF$ . The focus is the pole of the directrix, and the directrix is the polar of the focus. Quadric surfaces also have directrices. See POLE AND POLAR; CYLINDER.

**DIRGE.** See ELEGY.

**DIRICHLET.** dĕ'rĕsh'lĕ'. PETER GUSTAV LE-

**JEUNE** (1805-59). A German mathematician. He was born at Düren and was successively professor of mathematics at Breslau, Berlin, and Göttingen, where he succeeded Gauss in 1855. His memoirs on the theory of numbers are important, the most original being that on the determination of means with application to the distribution of prime numbers. He has also permanently influenced the theory of mechanics by his work on potentials. His papers on the theory of numbers were edited by R. Dedekind (Brunswick, 1879-81). His work on the theory of potentials was edited by F. Grube (Leipzig, 1887). His collected works were edited by Kronecker (Berlin, 1889-97).

**DIRIGIBLES.** See **AÉRONAUTICS**.

**DIRK.** A name used especially to designate the knife or dagger of the Scottish Highlander. Formerly worn under the vest or on the waist belt. See **DAGGER**.

**DIRKSEN**, dĕrk'sen, HEINRICH EDUARD (1790-1868). A German jurist. He was born at Königsberg and studied at Heidelberg and Berlin. In 1817 he was appointed professor of Roman law at the University of Königsberg, where he remained until 1829, when he received a call to Berlin. He was one of the greatest authorities of his time on the history and sources of Roman law, to which subject he contributed the following valuable works: *Zinlistische Abhandlungen* (2 vols., 1820); *Beiträge zur Kunde des römischen Rechts* (1825); *Manuale Latinitatis Fontium Juris Civilis Romanorum* (1837-39). Consult F. D. Sanis, *Zur Erinnerung an Dirksen* (Leipzig, 1870).

**DIRSCHAU**, dĕr'shou. A town of Prussia, in the Province of West Prussia, on the Vistula, about 19 miles southeast of Danzig (Map: Prussia, H 1). The river is here crossed by two fine bridges. The chief articles of manufacture are sugar, agricultural implements, and cement. There are also large machine shops and car works. Pop., 1900, 12,800; 1910, 16,894. Dirschau received municipal rights in 1260, and in 1308 it came into the possession of the Knights of the Teutonic Order. By the Peace of Thorn in 1466 it was given to Poland, but it became Prussian on the first partition of Poland in 1772. Consult Preusz, *Dirschaus historische Denkwürdigkeiten* (Danzig, 1860).

**DIS**, or **DIS PA'TER**. The Roman name for the god whom the Greeks called Pluto (q.v.).

**DISABILITY.** As a legal term, the want of power to do a particular act or class of acts. It may result from bodily or mental incapacity or from a rule of law. Of the first sort is the disability referred to in accident insurance policies, which provide for payments to persons who by reason of physical injuries are unable to work; also in statutes which make provision for the support of poor persons who are physically or mentally incapable of procuring a livelihood. Other examples of this class are afforded by lunatics and infants of tender years. Disabilities, in a rule of law, are those attaching to aliens, to infants who have reached the age of discretion, to married women under the common law, and to other special classes of persons. The reasons for imposing these legal disabilities upon persons who possess natural capacity for action are various. Some disabilities are intended as a protection or benefit to their subject, while others are imposed either by way of penalty or for the protection of individuals or of society at large. An example

of the first class is the legal incapacity of the minor who has not reached years of discretion. For his protection the law denies him the power of binding himself by contract. Yet the law does not sever him from responsibility for his torts or crimes. His disability is allowed to operate as a shield, but not as a sword. To the second class belong the disabilities imposed upon criminals or upon aliens or upon those who are denied the exercise of the elective franchise or are disqualified from holding public office. For a more detailed account of the legal consequences of legal disabilities, see **ADVERSE POSSESSION**; **ALIEN**; **INFANT**; **HUSBAND AND WIFE**; **CONTRACT**; **DEED**; **LIMITATION OF ACTIONS**; **NEGLIGENCE**.

**DISAPPEARING GUNS.** See **ORDNANCE**.

**DISAPPOINTMENT**, CAPE. See **CAPE DISAPPOINTMENT**.

**DISBARMENT.** The act of depriving an attorney, counselor at law, solicitor, or barrister of his rights and is such. The power to disbar rests with the Inns of Court and in the United States with the superior courts to whom is committed the power of admitting to the bar. They may take this action, upon sufficient cause, on complaint of any one, or of their own motion, where the cause comes to their knowledge directly. It may be exercised when an attorney has been guilty of gross contempt of court, dishonesty, extortion, or professional misconduct of a serious nature, and in some jurisdictions where he becomes a person of general bad character, so that he cannot be considered a fit person to be intrusted with the legal business of others. He must be given an opportunity to be heard in his own behalf, usually in open court, and may cross-examine any witness who may testify against him, and produce witnesses in his own favor, much as if he were under indictment for a crime. It is considered a severe penalty, as it deprives the person from earning a livelihood by his profession, and is only imposed in grave cases and after a thorough investigation and consideration. Where the conduct has been culpable, but there is reason to believe that it will not be repeated, the court will sometimes suspend the attorney from practice for a definite period, on the expiration of which he resumes his former rights and privileges. The court may restore one who has been disbarred to practice, in its discretion, where proof is presented that he will probably conduct himself properly in the future. See **ATTORNEY**, and consult the authorities there referred to; see also **BARRISTER**; **COUNSELOR**; **SOLICITOR**; **COURT**; **INNS OF COURT**.

**DISCANT.** See **DESCANT**.

**DISCHARGE** (OF. *descharge*, from *descharger*, Fr. *décharger*, It. *discaricare*, *scaricare*, from ML. *discargare*, *discarricare*, to unload, from *dis-*, away + *carricare*, to load, from Lat. *carrus*, car, from Gall. *carros*, Ir., Welsh, OBret. *carr*, car), **MILITARY.** At military law an enlisted man is, in general, entitled to his discharge from the service in writing when he has completed his term of enlistment. He cannot be discharged before the expiration of his term except (1) by order of the President; (2) by sentence of a general court-martial; (3) on a certificate of disability; (4) on a writ of habeas corpus. A discharge is either honorable, dishonorable, or without honor, depending upon the character of the service rendered and the



circumstances under which it is given. The President may, in his discretion, permit a soldier to purchase his discharge. By order of the President the authority to permit a soldier to purchase his discharge has been delegated to commanders of divisions and territorial departments. An officer failing on a reexamination is honorably discharged with one year's pay from the army. Consult *United States Army Regulations* (Washington, 1913).

**DISCHARGE BIBLE, THE.** See **BIBLE**, CURIOUS EDITIONS OF.

**DISCHARGE OF ELECTRICITY THROUGH GASES.** See **ELECTRICITY**.

**DISCIPLES OF CHRIST, or CHRISTIANS.** This religious body, sometimes called, without its consent, "Campbellites," represents a movement in the Church in the interest of union by a return in faith and life to the Christianity of the New Testament. They are distinctly American in their origin. Simultaneously in different sections of the country arose teachers among the religious denominations who pleaded for the Bible alone without addition in the form of creeds or formulas of faith, and for the union of Christians of every name upon the basis of the Apostles' teaching. This movement assumed most notable proportions in western Virginia and Pennsylvania, and in Kentucky. Thomas Campbell and his son Alexander (q.v.), of Bethany, Va., renounced the Presbyterian system and were immersed in 1812, and with the congregations they had formed united with the Redstone Baptist Association, and, 10 years later, with the Mahoning Association. In 1823 Alexander Campbell began to set forth with great vigor and learning, in a periodical entitled *The Christian Baptist*, a plea for the simple gospel order of things, as under the Apostles. It was not a reformation he urged, but "a restoration"; not the organization of a new sect, or the reformation of an old one, but a return to Jerusalem, the renewal of the ancient landmarks of the Christian religion, the restoration of apostolic Christianity, its doctrines, ordinances, and fruits. His protest against human creeds as bonds of union, and plea for the all-sufficiency of the sacred Scriptures, aroused opposition, and the views he advocated were in many quarters denounced as heterodox. Great numbers, however, accepted them, and under the preaching of Campbell and Walter Scott, an evangelist of the Mahoning Association, many new churches were formed, until the Baptists began to declare nonfellowship with these brethren, and they were forced to form themselves into distinct communities.

Barton W. Stone, a Presbyterian minister in Kentucky, began a similar movement to that of the Campbells in 1804. A church was organized at Cane Ridge, Bourbon County, accepting the Bible alone as possessing authority in the religious life, and the name "Christian" as a sufficient designation of all who believe on Christ. Correspondence between Stone and Campbell led finally to the union of the two movements in 1831.

In January, 1830, Mr. Campbell began the publication of the *Millennial Harbinger*, which he edited until his death in 1866. In his periodicals, by his preaching and debates, his views were widely circulated. In recent years the Disciples of Christ have made great advance in number, and along all lines of religious activity, until the statistics for 1913 show 9076

churches with 1,362,711 communicants. They report about 10,000 Bible schools, with an enrollment of about 900,000 children. They raised during 1912, \$1,038,338 for missions, home and foreign, and \$143,570 for other purposes. Among the 30 schools and colleges controlled by the church are Drake University at Des Moines Iowa; Ruth College, Indianapolis; Hiram College, Hiram, Ohio; and Valparaiso University, Valparaiso, Ind. Their strength lies chiefly in the north central States.

In agreement with what are termed Evangelical Christians, the Disciples accept the divine inspiration of the Holy Scriptures; the revelation of God in the tripersonality of Father, Son, and Holy Spirit; the all-sufficiency and alone-sufficiency of the Bible as a revelation of God's will, and a rule of faith and practice to His creatures; the divine excellency of Jesus Christ as the Son of God, His incarnation, doctrine, miracles, death as a sin offering, resurrection, ascension, and investment with supreme authority; the personal mission of the Holy Spirit to convince the world of sin, righteousness, and comfort and sanctify Christians; the redemption of man from God and his dependence upon the divine mercy in Christ; the necessity of faith and repentance to salvation; the importance of baptism and the Lord's Supper as divine ordinances; the duty of observing the Lord's Day in memory of the resurrection of Jesus Christ; the necessity of righteousness, holiness, and benevolence in Christians; the divine appointment of the Church of Christ, composed of all who by faith and obedience confess His name, with its ministries and services for the edification of Christians and conversion of the world; the fullness of the gospel to all who will accept it on the New Testament conditions; the final judgment with the reward of the righteous and punishment of the wicked.

In disagreement with other Christians, the Disciples hold that while both Old and New Testaments are equally inspired, both are not equally binding upon Christians; the Old was God's will with reference to the Jews, the New is His will with reference to us (Heb. i. 1). Accepting fully the Scripture statements concerning the Godhead, they repudiate the philosophical speculations both of Trinitarians and Unitarians and do not use the theological terms common to the schools, but insist upon "the form of sound words" given in Scripture concerning Father, Son, and Holy Spirit. Accepting the Bible as an all-sufficient revelation of the divine will, they repudiate all authoritative creeds and human fellowship. Receiving Jesus in all His deity and Christhood, they accept the truth that Jesus is the Christ, the son of the living God, as the one article of faith, as the creed of the church, the fundamental fact of Christianity, and belief with all the heart in Jesus as the Christ is all the confession of faith they ask preparatory to baptism and church membership. Recognizing the agency of the Holy Spirit in conversion, they repudiate all theories of special spiritual operations outside of the Word, demanding of the sinner that he shall hear, believe, repent, and obey the gospel in order to secure the remission of his sins. Admitting the necessity of faith and repentance, they submit no other tests, no human formula of belief, but on a confession of Christ and heartfelt desire to give up sin and work righteousness, men are baptized and received into

the church. Accepting baptism as a divine ordinance, they insist that "he that believeth and is baptized shall be saved"; they command men: "Repent and be baptized every one of you in the name of Jesus Christ for the remission of sins"; and claim that evidence of pardon and of the gift of the Holy Spirit is not in dreams and visions, but in the sinner's knowledge of his scriptural faith, repentance, and obedience to the gospel. Claiming the Lord's Supper to be a divine ordinance, they consider it not as a sacrament, but a memorial feast, and keep it on every first day of the week, meeting as the Lord's people and recognizing neither open nor close communion, since neither of these is known in the Scriptures of divine truth. On the Lord's Day, they hold it not as a Sabbath, but as a New Testament appointment in memory of the resurrection, to be observed as a day of rest and worship for the assembly and communion of saints, preaching of the gospel, administration of the ordinances, and training of families in the nurture and admonition of the Lord. Cherishing the Church of Christ, they regard it not as a sect, but a divine institution. They submit that sects are not branches of the Church of Christ, but are unscriptural. The body of Christ is one, of which Christ alone is the head.

The Disciples in regard to the action of baptism are in accord with the Baptists. Immersion is with them the only baptism that is scriptural and that could be universally accepted. As to the subjects of baptism, they baptize only believers in Christ. With respect to the design of baptism, they accord more with Pedobaptists. They baptize for "the remission of sins" and claim that the sinner in obeying this ordinance appropriates God's promise of pardon, relying on the divine testimony (Mark xvi. 16; Acts ii. 38). They date the beginning of the Christian institution on Pentecost, and the New Testament with them contains the history, constitution, and laws of the Church of Christ. In church government they are Unitarian and have no distinction of clergy and laity and recognize the local church with its elders and deacons as the highest ecclesiastical authority. They are ever, with district, State, and National conventions for missionary and benevolent work. These bodies are administered chiefly by the American Christian Missionary Society, with headquarters at Cincinnati, Ohio. In 1910 the society began a campaign to raise \$1,000,000 for American missions. This ends in 1915.

**DOCTRINAL.**—A. Campbell, *Disciples of Christ* (Cincinnati, 1853); I. Errett, *Our Position* (Cincinnati, 1885); J. H. Edwards, *Orthodoxy in the Civil Courts* (ib., 1887); J. S. Lamar, *First Principles and Perfection* (New York, 1895); B. B. Tyler, *Peculiarities of Disciples* (Cincinnati, 1897); J. H. Garrison, *Old Faith Restated* (St. Louis, 1890); F. D. Power, *Bible Doctrine for Young People* (ib., 1899). **HISTORICAL.**—Richardson, *Life of Alexander Campbell* (Philadelphia, 1868); Williams, *Life of Elder J. Smith* (Cincinnati, 1870); Baxter, *Life of Elder W. Scott* (ib., 1874); B. B. Tyler, *History of Disciples* (New York, 1894); Power, *Sketches of our Pioneers* (Cleveland, 1898); J. H. Garrison, *The Reformation of the Nineteenth Century* (St. Louis, 1901); Gates, *Disciples of Christ* (New York, 1905); Carroll, *Religious Forces of the United States* (ib., 1912).

## DISCIPLES OF SAINT JOHN. See CHRISTIANS.

**DISCIPLINA ARCANI** (Lat., discipline of the secret). A seventeenth-century term, applied to the custom of the early Church which treated certain rites as mysteries and withheld them from the knowledge of the uninitiated. There is no trace of this secret discipline before the end of the second century. It emerges into view during the third and is well established in the fourth and fifth centuries, which constitute its most flourishing period. The writers who set forth the mystery idea are Origen, Athanasius, Basil, Epiphanius, Chrysostom, Cyril of Jerusalem, Cyril of Alexandria, Theodoret, Ambrose, Augustine, and Pseudo-Dionysius Areopagita. It appears also in the Apostolic Constitution. From the sixth century onward, when Christianity had won the victory over paganism, we hear less and less of the secret. Its influence is clearly traceable in Eastern and Western Catholicism, even down to modern times (cf., e.g., the *Russian Catechism* of 1839).

Baptism and the eucharist were the two rites of the Church to which especially the mystery idea became attached. Baptism was called a "seal," or "illumination"; those baptized were "the initiated" and "the uninitiated"; the holy communion, the creed, and the Lord's Prayer were "mysteries." All this denotes assimilation of heathen modes of expression and of thought. The creed came to be regarded as a mystery because it was formally delivered to the catechumens at his baptism; the Lord's Prayer, because of its prominence in the communion office. These things were often withdrawn from public mention, or referred to only remotely, with such words as "the initiated know what I mean," etc. Symbolism was used, as in the famous inscription discovered at Arles in 1839: "Take the food, sweet as honey, of the saviour of the holy ones, and drink, holding the fish in thy hands"—words utterly profane, but perfectly clear, for whom the fish was the symbol of Christ, the initial letters of the Greek words for "Jesus Christ, Son of God, Saviour," forming the word *ixθύς*, 'fish.' Sozomen will not include the Nicene Creed in his *History*, for fear some of the profane may read the book. Ambrose warns the Church to "guard against incautiously divulging the mystery of the creed or of the Lord's Prayer." Chrysostom explains reticence with regard to the latter by asserting that "no unbaptized person can call God his Father." Athanasius rebukes those who are "not ashamed to parade the sacred mysteries before catechumens, or, worst of all, even before heathen." It was the general opinion that familiarity with such sacred things must be guarded. Basil observes that "the revelation of the mysteries is preserved by silence." And Augustine goes so far as to assert that concealment, by provoking curiosity, helps along the extension of Christianity; for the uninitiated are eager to learn the secrets which the Church so carefully guards!

The reason for this custom lay in the circumstances of the early Church. The early Christians, surrounded by pagan populations who were only too prone to misinterpret their teachings, and severely persecuted by the government, naturally sought concealment and practiced a prudent reticence. Regarding their doctrines as a sacred deposit, they shrank from recklessly com-

municating them to the profane who might distort them. Experience had taught them, moreover, that all neophytes were not sincere, and the danger of betrayal by informers who pretended conversion led them to guard the more intimate doctrines and practices from catechumens until after a long probation. Further, it was not deemed wise to communicate the fullness of truth to the unprepared mind, and for this reason also the neophyte was only gradually inducted into the mysteries of the faith. The mysteries of the Græco-Roman and Oriental religions also had an influence upon the habits of thought of the early Christians. Roman Catholics hold that the discipline of the secret originated in apostolic times and urge that the words of Tertullian (*Præscript.* 41) indicate that it was already a well-established tradition in his day (150-230). Speaking of certain heretics, he says: "Among them it is doubtful who is a catechumen and who is not; all come in alike; they hear together and pray together." As regards its subject matter, Protestant writers generally contend that it embraced merely certain rites of worship, and that the silence of early Christian writers on certain doctrines is evidence that they were not held by the primitive Church. Roman Catholics hold that the system included doctrines as well as rites, and that it explains the silence of certain writers on points afterward held to have been handed down by continuous tradition. For the division of the eucharistic service into two parts, from the more sacred of which the unbaptized were excluded, see LITURGY.

For the Roman Catholic view, consult: Schelstrate, *De Disciplina Arcani* (Rome, 1685); for the Protestant view, Tentzel, *Dissertatio de Disciplina Arcani* (Leipzig, 1692); also in general, Bingham, *Antiquities of the Christian Church*, bk. ix (London, 1855); Hatch, *The Influence of Greek Ideas and Usages upon the Christian Church* (London, 1883); Anrich, *Das antike Mysterienwesen in seinem Einfluss auf das Christentum* (Göttingen, 1894); A. Weiss, *Die altkirchliche Pädagogik* (Freiburg, 1869); Wobbermin, *Religionsgeschichtliche Studien* (Berlin, 1896).

**DISCIPLINE** (Lat. *disciplina*, from *discipulus*, disciple, from *discere*, to learn). The method or code by which practices, rules, regulations, etc., are enforced. Applied to the individual, it implies a system of mental and moral training. In its military aspect it is the means by which the army in whole or in part is enabled to respond promptly and efficiently in answer to an order. It is the keynote of military efficiency and *morale* in that without it uniformity, organized effort, and the effective working of the complex machinery of a successful military organization are impossible. See TACTICS, MILITARY.

**DISCIPLINE, ECCLESIASTICAL.** The corrective and preservative function by which organizations for the purposes of religion seek to maintain their standards of order and conduct among their members. It is a function common to all religious bodies, though it varies greatly in the objects to be attained and the means used. While the standards to be maintained have continued substantially the same, the procedure and the punitive facilities at the command of the churches have undergone radical alteration. The changes have been due in large measure to the changed relations which the

churches bear to the state. At the close of its history the Christian Church followed a disciplinary procedure upon that in vogue in the Hebrew synagogues, where there were three degrees of punishment, all of which were species of excommunication. In the ancient Hebrew state the religious organization of society had the active cooperation of the political power in the enforcement of its discipline, which cooperation, however, was lost, with the loss of political independence. The Christian Church in the apostolic and subapostolic ages was in a similar position and lacked the aid of the civil power in the enforcement of its discipline. In the early ages of the Church certain crimes were subject to the discipline of public penance. We learn from Tertullian on *Purity* (c. 14, and 12) and from Pacianus that they can be reduced to the heads of infidelity, luxury, and homicide. St. Gregory of Neo-Cæsarea mentions the four classes into which the public penitents were divided. They were the weepers, the hearers, the prostrate, and those who remained (consistentes). The weepers were kept entirely outside the church door; the hearers were admitted just within the door; the prostrate, under the same rule as the hearers, were excluded from the most sacred portions of the service; the remaining penitents (consistentes) were allowed to hear the whole service, but could not receive the eucharist. (See ABSOLUTION; LAPSED.) When the church came to be recognized by the state as the normal organization of society for the purposes of religion, her disciplinary facilities were enormously increased because of the aid received from the civil power. What had before been considered merely conduct unbecoming a baptized Christian came in many cases to be a breach of the civil law, of which the civil authorities would take cognizance. This relation of states to the churches has continued in varying degrees in the different countries of Christendom. The ancient order has been most fully preserved, perhaps, in the Empire of the Russias, where the church is recognized by the state as the normal organization of society for the purposes of religion and where the police power of the state is in many cases at the disposal of the ecclesiastical authorities. In Western Christendom, however, the development of the sphere of individual liberty so as to include liberty of speech and action in religion has caused individual ecclesiastical relations to be largely voluntary and has reduced the punitive facilities of religious organizations to a minimum, never exceeding expulsion from the communion and church fellowship. The Church of Rome has, of all the churches, retained the most elaborate system of discipline, by the side of which has also been maintained a system of dispensations (see DISPENSATION), yet the penalties are merely ecclesiastical and not civil. It divides discipline into (a) dogmatic, which prescribes what should be believed, and (b) moral, which has to do with the conduct of life. In the Protestant churches discipline consists in the infliction of three penalties: (1) public censure, which is, as a rule, resorted to only after private admonition has been given; (2) suspension; and (3) excommunication. In Congregational churches discipline is administered by the church body. In the Presbyterian churches these powers are exercised by the session, an appeal lying to the presbytery, thence to the synod and general assembly. In the Methodist Episcopal church an accused member is brought

to trial before a committee of not less than five members, who shall not belong to the quarterly conference; if a majority find him guilty, the pastor executes the sentence, appeals being allowed to the quarterly and annual conferences. Unlike the voluntary bodies, the established churches, such as the Church of England and the Protestant establishments on the continent of Europe, have lost nearly all disciplinary powers over the laity, who have practically by virtue of citizenship the privileges of church membership.

In the United States church discipline is administered exclusively by church officials and judicatories. The complete separation of church and state deprives the civil tribunals of all power to revise or question ordinary acts of church discipline or of exclusion from church membership. If the rights of property and of personal liberty are illegally invaded by church discipline, the civil courts have authority to afford redress.

Whether a church member is amenable to ecclesiastical punishment is to be determined by the proper officers or judicatories of the particular church, in accordance with its rules of government and discipline. From their final decision no appeal lies to a civil court. In the language of the United States Supreme Court (*Watson vs. Jones*, Dec. 1871, 13 Wallace p. 728): "The law knows no heresy and is committed to the support of no dogma, the establishment of no sect. The right to organize voluntary religious associations to assist in the expression and dissemination of any religious doctrine, and to create tribunals for the decision of controverted questions of faith within the association and for the ecclesiastical government of individuals, congregations, and officers, within the general association, is unquestioned. All who unite themselves to such a body do so with an implied consent to this government and are bound to submit to it." The disciplinary authority of such bodies, and the rights and duties of their members, are governed by the same general rules of law that control in case of social or political clubs or other private organizations. See CANON LAW.

**DISCIPLINE, THE.** A form of self-castigation. See FLAGELLATION.

**DISCLAIMER** (from *disclaim*, OF. *disclamer*, *desclamer*, from ML. *disclamare*, to renounce, from Lat. *dis-*, apart + *clamare*, to claim; connected with Lat. *calare*, Gk. *καλεῖν*, *kaleîn*, to cry aloud). In law, a renunciation, repudiation, or disavowal of . . . or liabilities by words or conduct . . .

1. In actions involving real estate, a renunciation by a party of his character as tenant of one of the other parties to the action. Where a tenant sets up a claim of title in himself, superior to that of his landlord, or alleges that the one of whom he nominally is . . . is not the owner, or has not . . . in the property to execute a valid lease, and refuses to recognize him as his landlord, it is said to be a disclaimer, and, even if not sustained by the proof, works a forfeiture of the lease at the election of the landlord. A mere verbal refusal to recognize the lessor as landlord is not considered sufficient; it must be made where it will become a matter of record, as in a proceeding involving the rights of the landlord in the property. See EJECTMENT; LANDLORD AND TENANT.

2. The act by which a person refuses to accept an estate which is devised or conveyed to

him. This is usually accomplished by a deed or other writing, and, in order to be recognized without making application to the court, should be made before the devisee or grantee has in any way, by words or acts, shown assent to the devise or conveyance. It most frequently occurs where property is conveyed to one as trustee for another, and he does not care to assume the duties and responsibilities of the trust. See EQUITY; TRUST.

3. In equity pleading, a written statement by the defendant, disavowing or renouncing any interest in, or claim to, the matters set forth in the complainant's bill. It is a formal mode of defense and entitles the defendant to a hearing on the question as to whether he has any interest or connection with the matters in controversy, and, if he succeeds in . . . that he has not, he is entitled to an order striking out his name as party defendant. It does not deny any of the material allegations of the bill and is not available where facts are alleged which, if not controverted, would show a liability on the part of the defendant. Usually, therefore, it accompanies an answer, and the two pleadings are considered together. See PLEADING.

4. In patent law, a properly attested writing stating that the one who executes it is a patentee of a certain invention, and that he has discovered since filing his claim that he was not the first inventor of, and therefore wishes to eliminate from his claim a part of the thing which he originally included, through mistake or inadvertence, in the specifications, or statement of the nature and object of his invention. This should be attested by witnesses and filed and recorded in the Patent Office, and it is then considered as a part of the original specifications. The part which he seeks to retain must be clearly separable and . . . from the part eliminated and still be a patentable invention. Fraud or deception in making his original application will prevent a patentee from taking advantage of this rule. See INVENTION; PATENT; SPECIFICATION.

**DIS'CO**, or **DIS'KO**. A large island off the west coast of Greenland, in lat. 70° N. (Map: Arctic Regions, H 7). It is separated by a narrow channel from the Nugsuak Peninsula, and from the mainland on the south and east by Disco Bay. Disco Fiord deeply penetrates it from the west. The island has more than 3100 square miles and rises over 3000 feet. Godhavn, or Lieveby, on the south coast, is the seat of the Danish administration for northern Greenland and has 300 inhabitants.

**DISCOB'OLI** (Neo-Lat. nom. pl., from Gk. *δισκοβόλος*, *diskobolos*, discus-thrower, from *δίσκος*, *diskos*, discus + *βάλλειν*, *balleîn*, to throw). A group of fishes characterized by the union of the rudimentary ventral fins to form the bony centre of a ventral sucking disk, enabling its possessor to attach itself to other objects. As now defined, the Discoboli include two or three families and about 50 species, inhabiting the northern seas, of which well-known examples are the lump-suckers (q.v., for illustrated details). Cuvier included the remora, a fish now placed in another group.

**DISCOB'OLUS** (Lat., from Gk. *δισκοβόλος*, *diskobolos*). The thrower of the discus (q.v.). The most celebrated statue of a discobolus was executed in bronze by the Athenian sculptor Myron (q.v.). It is known from several marble copies, the best of which is a life-size statue in

the palace of Prince Lancelotti at Rome, found on the Esquiline in 1761. This statue represents the athlete at the moment of greatest muscular tension, when, having swung the discus back to the full stretch of his arm, he is about to hurl it forward with all his strength. Consult E. A. Gardner, *A Handbook of Greek Sculpture*, p. 238 (London, 1911). Another celebrated marble copy is in the Vatican; for a photograph of this and an account of the discus throwing, consult Gardiner, *Greek Athletic Sports and Festivals* (London, 1910). See Plate of GREEK ART.

**DISCOGLOSSIDÆ** (Neo-Lat. nom. pl., from Gk. *δίσκος*, *dískos*, discus + *γλῶσσα*, *glōssa*, tongue). The . . . frogs, a small family having many . . . of structure, prominently the disklike form of the tongue, and the fact that in the advanced tadpoles the breathing pore is in the middle of the under surface of the body instead of on the left side. The painted frog (*Discoglossus pictus*) of southern Europe is a typical form, and other representatives are the feuerkröte (q.v.), the African midwife frog (q.v.), and others of the genus *Alytes*, and a small species (*Liopelma hochstetteri*) of New Zealand, notable as the only amphibian native to those islands.

**DISCOMYCE/TES** (Neo-Lat. nom. pl., from Gk. *δίσκος*, *dískos*, discus + *μύκης*, *mykēs*, fungus). A name formerly applied to those groups of Ascomycetes (q.v.) whose ascocarps are open, . . . disks, saucers, cups, funnels, etc. . . . carps are seen most commonly on lichens.

**DISCOPH'ORA**. See JELLYFISH; MEDUSÆ.

**DISCORD** (OF. *descoorde*, Fr. *discord*, It. *discordia*, *scordia*, from Lat. *discordia*, from *dis-*, inharmonious, from *dis-*, apart + *cor*, heart). Sounds that have no harmonical relation whatever; differing from dissonance (q.v.), which in musical language is applied to sounds that are in . . . correct relation to one another, . . . nsonant. Discord is sometimes wrongly used for dissonance.

**DISCORDAL STONES**. See ARCHEOLOGY, AMERICAN.

**DISCORDIA**. In Roman mythology, the goddess of strife, known to the Greeks as Eris (q.v.).

**DISCOUNT** (ML. *discomputus*, from *discomputare*, to discount, from Lat. *dis-*, apart + *computare*, to reckon, from *com-*, together + *putare*, to cleanse, from *putus*, pure). A deduction from a stated price or from a sum due at a future time. Merchants often deduct a certain sum from an account if payment is made before the bill is due. Business houses commonly publish price lists which in course of time are corrected by means of stated discounts. Even double and triple discounts are common. Thus 10 per cent off 20 per cent off 40 per cent means a reduction of 40 per cent from the list price, and a reduction of 20 per cent from this amount, and finally a reduction of 10 per cent from this result. Such discounts are called *trade* or *commercial* discounts.

Banks, in purchasing promissory notes before they are due, customarily deduct from the amount of the note at maturity a certain per cent, called *bank* discount. In case of loans it is customary for banks to deduct the interest in advance, leaving the borrower an amount equal to the face of the note less the interest. The form of discount known as *true* discount is

now practically obsolete. It was computed thus: Divide the future worth of the note, i.e., its amount at maturity, by the future worth of one dollar, and the result is the present worth of the note. The difference between the future and present worth is the true discount. By discount is also meant the depreciation expressed as a rate per cent of the par value of a fixed investment; e.g., on railway stock bought at 115 and sold at 95, there is 20 per cent discount. The rates of bank discount vary according to the demand for money and the nature of the security. The range in the United States is approximately from 3 per cent to 10 per cent except in case of doubtful securities, where . . . es are exacted.

**DISCOVERY** (from *discover*, OF. *descovrir*, Fr. *découvrir*, It. *discoprire*, from ML. *discōperire*, to discover, from Lat. *dis-*, away + *cooperire*, to cover, from *co-*, together + *operire*, to cover), TITLE BY. The title or sovereignty acquired by a nation through the discovery by its agents or subjects of territory over which no other power exercises sovereignty. As the foundation for claim of title, discovery has ceased to be of practical importance with the disappearance of unexplored regions and has given place to *occupation* as a means of conferring proprietary or sovereign rights. International law considers discovery to give only inchoate title, which must be completed by occupation, by settlement or military posts within a reasonable period, and the untimely interference of another state with the territory affected might justifiably be construed as a hostile act. What acts are sufficient to effect absolute title, and what is a reasonable time, can only be determined by consideration of the circumstances of each particular case. For instance, the act of discovery is valid until a proper time has elapsed for the preparation of an expedition for permanent occupation. But this presumption ceases when standing alone, compared with acts of continuous or actual settlement by another power. Where exploration is made and other evidence of interest given, the extinction of the claim may be long postponed unless confronted by a definite act of appropriation by another state without protest. So, in conclusion, it may be said that the intention of a state to take possession of territory discovered by its subjects must be promptly signified in some unmistakable manner if it is to be available against foreign interests seeking a foothold. The same rule applies to occupation as a root of title.

The titles which Spain and Portugal first claimed in the New World were founded on papal grants. In 1493 Alexander VI granted to Spain all lands beyond a line 100 leagues west of the Azores. This was later modified by treaty with Portugal fixing a new line 370 leagues west of the Cape Verde Islands. Such claims were disregarded by the Protestant states, which sent out agents commissioned to discover and acquire any "heathen lands." These discoveries were made the basis of claim of title absolute and were of practical value in giving significance to subsequent acts in themselves doubtful or inadequate. The discovery was followed by some formal act of possession in the planting of a flag or erection of a monument as notice of the intention of the state to whom the expedition belonged. The claims based on these discoveries and confirmed

by later occupation and settlement developed the conflicts which have marked the history and determined the possession of the Western Continent. Writers on international law uniformly hold that discovery, to be effective, must be made by authorized agents of a state, or that, if made by a private citizen or subject, the act be promptly adopted by the government. This was declared to have been the weakness in the American case in the Oregon Question (q.v.). Captain Gray entered the mouth of the Columbia River in 1792 in a small vessel. No recognition was made by the United States government at the time, and shortly afterward Captain Vancouver, engaged in surveying the coast for the British government, sailed several miles up its course. In 1811 the post of Astoria was founded by the Pacific Company, a private corporation. The dispute was settled by the Treaty of 1846 without expressly conceding the American claim. Africa furnishes almost the only territory to which the principles of discovery and occupation now have a vital application. In 1856 the United States adopted a code of rules to govern the rights of discovery of guano islands. Consult the authorities referred to under INTERNATIONAL LAW.

**DISCOVERY, BILL OF.** An equitable remedy which is sometimes used to enable a plaintiff or defendant in an action, either at law or in equity, to obtain information and proof as to facts and documents necessary for the prosecution or defense of his case, where such means of proof are within the knowledge or possession of the opposite party. The bill should not ask for any relief as to the matters in controversy, but may ask for an injunction staying further proceedings in the action until the discovery is obtained. It must only ask for the disclosure of facts or the production of deeds, writings, or other things in which the party has a title or interest, and which are essential to be established in order to sustain his side of the case, and must show some merit in his claim or defense. Thus, a devisee of real property under a will might maintain such a bill for the production of the title deeds of the particular property to which he has become entitled, in order to trace the deviser's interest, and consequently enable him to establish his claim. The bill must not demand any information which is clearly only in the nature of evidence for the opposite party, as it is not for the purpose of compelling him to disclose the manner in which he will endeavor to establish his side of the case. It will only be entertained in civil, not in criminal, actions. It is still a common remedy in States having separate courts of law and equity, but has been abolished or has fallen into disuse in States having codes of civil procedure, as in New York, where a party has a right to call his adversary as a witness and compel the production of books and documents by *subpoena duces tecum*. In England discovery is no longer confined to a bill in equity, but may be had on proper application to the High Court. See EQUITY; EVIDENCE; SUBPOENA.

**DISCOVERY, THE.** 1. The small ship in which Henry Hudson explored the northeastern coast of America in 1610. The vessel was later commanded by Sir Thomas Button, who discovered Nelson's River, and still later (1615-16), by Baffin and by Bylot. She was originally built (1602) by the East India Company, to discover the "Northwest Passage," under the

command of George Waymouth. 2. A steam vessel employed, together with the *Alert*, on the British Arctic expedition (1875-76) under Sir George Nares.

**DISCRIMINANT.** See EQUATION; DETERMINANTS.

**DISCRIMINATION** (Lat. *discriminatio*, from *discriminare*, to discriminate, from *discernere*, to discern, from *dis-*, apart + *cernere*, to perceive). A distinction made between patrons by one engaged in a public or common calling, such as that of common carrier or innkeeper. Such discrimination is a violation of a duty imposed by the common law. It is the legal duty of every one engaged in such a calling to serve all persons in the order in which they present themselves and to charge no one more than a reasonable rate. Speaking generally, he must treat all alike; he must afford equal accommodations and facilities to all, and he must not exact from any one an excessive rate for his services. Further than this, however, his common-law duty does not extend. He is at liberty to charge less than a fair rate to any one. Others, it is held, cannot justly complain of such favoritism, so long as his charges to them are reasonable in amount. In the language adopted by the New York Court of Appeals, "Re . . . preference in rates of compensation, the carrier's obligation is to charge no more than a fair return in each particular transaction, and, except as thus restricted, he is free to discriminate at his pleasure. This is the equal justice to all which the law exacts from the common carrier in his relations with the public." To put it in another way, the common law prohibits positive discrimination, but does not forbid negative discrimination. It does not permit the common carrier to transport one man's goods in preference to those of another; but it does allow him to carry for favored individuals at an unreasonably low rate, or even gratis.

When railways came into operation, their managers took advantage of this rule of the common law and made especially low rates to those who gave them their exclusive patronage as well as to those whom they chose for any reason to favor. This practice has evoked a good deal of legislation, both in England and in the United States, having for its object the prohibition of every form of discrimination or preference by carriers. The earliest statute on this subject is the act of Parliament known as the Railways Clauses Consolidation Act of 1845. Its main purpose was to prohibit a common carrier from charging more to one person than to another at the same time, it charged to others the same kind of service. It has served as the model for Federal and State statutes in the United States. In some of the States the principle has been embodied in constitutional provisions. This is a sound public policy. It operates to prevent great railroad corporations from building up the business of favored individuals to the injury of others.

The most important piece of Federal legislation bearing on this topic is that known as the Interstate Commerce Act of 1887. Its avowed purpose is to promote and facilitate commerce by the adoption of regulations to make charges for transportation just and reasonable and to forbid undue and unreasonable preferences or discriminations. The evils which it was intended to correct have been judiciously described



as ordinarily taking "the shape of inequality of charges made, or of facilities furnished, which are usually directed by or tolerated for the promotion of the interests of the corporation itself, or for the benefit of some favored persons at the expense of others, or of some particular locality or community, or of some local trade or commercial connections, or for the destruction or crippling of some rival or hostile line." The act does not attempt, however, to prohibit all discriminations and preferences. It aims only at those which are unjust and unreasonable. It does not ignore the principles that one can sell at wholesale cheaper than at retail, nor that the carrier should be allowed to make a specially low rate to secure business which would otherwise go by other competitive routes. For later legislation, including that of 1906, see RAILWAYS.

See INTERSTATE COMMERCE COMMISSION and authorities there cited; consult also Beale, *On Bailments*, chap. xi (London, 1900); *Interstate Commerce Commission vs. Baltimore and Ohio Railroad*, 145 U. S. 263 (1892); *Texas and Pacific Railway vs. Interstate Commerce Commission*, 162 U. S. 197 (1896).

**DISCRIMINATION, SENSIBLE, or DIFFERENTIAL SENSITIVITY.** The name applied to an intellectual function of extreme importance—our capacity to pronounce upon the likeness or difference of sense presentations. The phrase "must not be taken to denote a faculty of comparison, in the sense of a peculiar conscious process existing alongside of the various contents. It merely expresses, in the first instance, the general fact that we have different experiences and experience them differently; in other words, it covers the introspection (q.v.) of different contents and the report of their difference. . . . But we also use it to indicate our experience of like contents, and our report of their likeness." (Kölpe.) The differential sensitivity would, then, be exercised if we were called upon to judge of the likeness or difference of two reds or of the *a* of two violins. In such cases we (*a*) experience the colors and tones in the same or in different ways; they make the same or a different impression upon our mind; while we then (*b*) formulate this experience in words, saying "like" or "different," as introspection dictates. The former process, of introspective discrimination, is termed the *direct*, the latter, of rendering the experience in words, the *indirect*, differential sensitivity. There are, then, two problems before us. We must ask, first, as to the conditions under which we are able to discriminate, and the limits within which discrimination is valid; and, second, as to the adequacy of language to reflect or reproduce the results of introspection.

1. A very little consideration suffices to show that an accurate comparison of sense contents cannot be undertaken in any and every case of difference; but that certain favorable conditions are necessary to a reliable judgment. Suppose, e.g., that we have two reds before us—a saturated red, and a reddish gray of the same tint. (See SATURATION.) It is impossible, with all imaginable care in comparison, to assert that the saturated red is three or four or any definite number of times as red as the less saturated color. The one impression is that of a "good" red; the other that of a dull or gray red; more we cannot say. Or suppose that three pressures are given—a light, a moderate,

and a heavy. It is impossible to assert with any confidence that the moderate pressure is three times as much heavier than the light as the heavy is than the moderate; we can say that the former difference is "a good deal greater" than the latter, but that is all. Now experiment has proved that the conditions favorable to exact discrimination are realized in two, and only in two, instances; and it is, accordingly, with these that investigators of the differential sensitivity have occupied themselves. The first instance is that of "difference determination," the second is that of "difference comparison." In the former procedure the aim is to determine the "just noticeable difference" between two like contents; in the latter, to effect an equality of sensation differences or sense distances. An illustration of difference determination appears under the title AUDITION (q.v.); it is found that two tones are discriminable, in the middle region of the musical scale, if their pitch numbers differ by 0.2 of a vibration. This value measures the just noticeable difference of tonal quality. As illustrations of difference comparison, we may take the following: given two tones, it is required to find a tone which lies, for sensation, midway between them; and, given a black and a white, it is required to find a gray which appears to be equidistant from both. Let the tones have, e.g., the pitch numbers 200 and 400; then the middle tone has (approximately) the pitch number 300; the stimulus distance 300-200 is equal, in sensation, to the stimulus distance 400-300. In other words, we have the required middle tone when we have the *arithmetical mean* between the two tonal stimuli. With the lights the case is different. Let the unit of black have the photometric value 1, and the unit of white the photometric value 60; so that a white disk ( $360^\circ$ ) stands to a black disk as  $360 \times 60$  to  $360 \times 1$ , or as 21,600 to 360. The middle gray is not the arithmetical mean, a disk of  $180^\circ$  white and  $180^\circ$  black (value 10,980). This mixture appears much too light. The middle point is found rather with a disk of some  $41^\circ$  of white and  $319^\circ$  of black, i.e., with a stimulus whose photometric value is approximately 2788, the *geometrical mean* between the limiting black and white. It is clear, then, that the course of the differential sensitivity is not the same for tones and for lights. By an extension of experiment to the qualities of the other senses, and to the sensation attributes other than quality (see SENSATION), various laws of the differential sensitivity have been established. (For an example, see WEBER'S LAW.) A valid determination of these laws is possible only on the condition that the sources of experimental error are strictly controlled by the investigator. Attention, expectation, and practice must be at their best; habituation and fatigue must be avoided (see these terms). The "constant errors" of time and space must also be ruled out; as many experiments must be taken in the time order *ab* as in the order *ba*, and as many with stimulus *a* to the right as with the same stimulus to the left; and the results of the double series averaged. Moreover, the instruction given to the observer must be specific and clearly formulated and must be frequently repeated, since the attitude which is set up by the instruction determines not only the direction of attention but also the mode of apprehension of the problem in hand.

So far we have spoken of the *magnitude* of the differential sensitivity. This may be expressed in two ways, absolutely and relatively. If, e.g., I can just distinguish a light of 50-candle power from one of 50.5-candle power, the value .5 gives a measure of the absolute, and the value  $.5/50$  or  $1/100$  a measure of the relative differential sensitivity. But we can also measure the *delicacy* of the discriminative function. An observer might, in one test, distinguish between lights of 50 and 50.2, while in the next . . . he could distinguish only between . . . Here the magnitude of the differential sensitivity, as averaged from the two tests, is .5; but the observer is evidently less delicate of discrimination than another who should give the values 50.4 and 50.6 in successive trials. Not only the average, but also the fluctuation of that average, must therefore be considered in a general measure of discrimination.

2. We turn to the question of the indirect differential sensitivity. And we must note, in the first place, that the importance of language as an instrument of psychology can hardly be overestimated. The flexibility and ready variation of the spoken sentence and the permanence of the written record are very great advantages. Still, language is discrete, while the stream of consciousness is continuous; so that, at the best, we are seeking, so to say, to reproduce a fresco by a mosaic. Moreover, the relation of the contents of consciousness to the words that describe them is not constant; while some experiences call up habitual and familiar phrases, others baffle us, cause us to pick and choose our terms, and to halt for the right expressions. We cannot, then, take it for . . . ermination and the report . . . always run parallel, that the "good observer" is necessarily a "good reporter." The difficulty which here presents itself may be overcome by a fitting instruction given to the observer. Suppose, e.g., that the observer is asked to discriminate between two weights; he is instructed (1) to judge the second weight in terms of the first, and (2) to report the second weight as "heavier," "lighter," or "the same." Not only, as we have seen above, does such an instruction set up an attitude which determines the clear apprehension of the task, and the direction of attention to the specific problem; it also determines the exact terms in which the report is to be formulated. With practice such a report may become as automatic as the direct discrimination, so that a uniform series of results is assured. Consult: Fechner, *Elemente der Psychophysik* (Leipzig, 1889); Wundt, *Grundzüge der physiologischen Psychologie* (ib., 1910-11); Kuelpe, *Outlines of Psychology* (London, 1909); Titchener, *Experimental Psychology* (New York, 1905).

**DISCUS** (Lat., from Gk. *δίσκος*, *diskos*, disk) **THROWING**. An athletic sport. Originally the discus was a circular piece of stone (sometimes metal) about twelve inches in diameter, which the *discobolus* (Gk. *δισκοβόλος*), or thrower, in the ancient Greek games pitched from a fixed mark to the greatest possible distance; the competition of rival athletes constituting the game. In the ancient Olympic games discus throwing was one of the five exercises of the pentathlon, and it was introduced in the revival of the games at Athens in 1896. In this contest the discus must weigh 4 pounds,  $6\frac{1}{2}$  ounces, and must be thrown from an 8-foot,  $2\frac{1}{2}$ -inch

circle. Under these conditions an expert may throw the discus 140 feet or more. See DISCOBOLUS.

**DISEASE**, *dīz-ēz'*. "Any departure from, failure in, or perversion of normal physiological action in the material constitution or functional integrity of the living organism" (Foster's *Medical Dictionary*). Practically, a disease is a particular condition of ill health dependent upon some cause other than normal decay from age. Convenient, though not strictly scientific, is the division of diseases into functional and organic. A disease is organic if a certain organ is affected by it, changes occurring in the tissues. In a functional disease the organ in question does not properly perform its functions, but is itself intact; properly the disease exists elsewhere than in that organ, the organ being disordered as a reflex result of distant changes. Diseases are termed diathetic when dependent upon a predisposition or diathesis (q.v.); they are termed enthetic when arising from external causes entirely. Many diseases arising from the entrance and growth of bacteria from without are called germ diseases. . . . diseases are those caused by altere. . . . of the cells of the body. This altered function may be due to the action of bacteria, which are naturally found in the body, as in the digestive tract. The retention of feces in the intestine, or of uric acid or peptones and albumoses in the blood, causes disease from the generation of poisonous alkalis termed leucomaines. See BACTERIA; DISEASE, GERM THEORY OF; MEDICINE; DISTRIBUTION OF DISEASES.

**Feigning of Disease**. This is much practiced in the army and navy, and by convicts and others anxious to escape from discipline, or procure a discharge from compulsory service. It is also practiced by unfortunates who want to rest in hospitals during the winter, or by impostors who seek to gain money by arousing sympathy. It is technically called *walingering*. The detection of feigned disease, of course, necessitates the aid of the educated physician, and is . . . a thorough . . . of the reality, unless, indeed, the . . . be very crude. The diseases most commonly simulated are epilepsy, catalepsy, convulsions, blindness, deafness, paralysis, insanity, neuralgia, rheumatism, disease of the heart, and generally all disorders which may exist without leading to any distinct external appearances. Ulcers of the legs, however, have often been made, and kept open artificially through the application of irritant substances, and vomiting or coughing up of blood is very easily simulated. The detection of such impostures is easy or not according to the opportunities and knowledge and skill of the deceiver, as compared with those brought to bear on the discovery of the fraud. Careful testing is always necessary, as well as observation of the patient when he is unconscious of it. The medicolegal importance of this subject is decided. Many actions are brought against railroad companies to recover damages for alleged injuries resulting in nervous diseases. It rests with the neurologist to decide if such diseases exist, and none but an expert can determine the truth. The questions then arise whether the nervous disease existed before the injury, or whether it was aggravated by the injury so as to incapacitate the patient, or whether it has appeared since the injury and is due to a subsequent cause. For a consideration of the



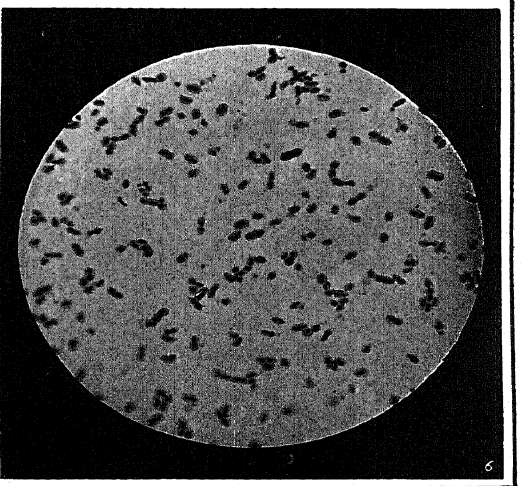
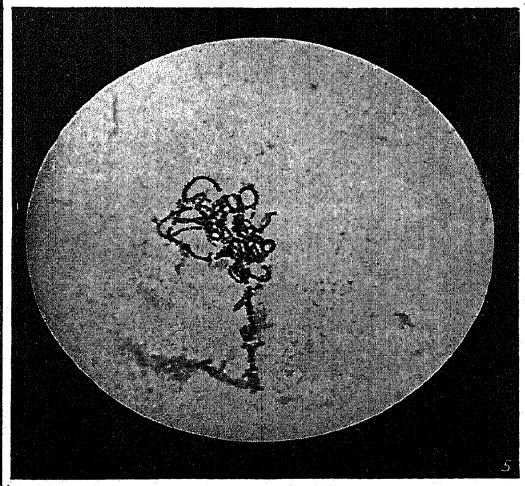
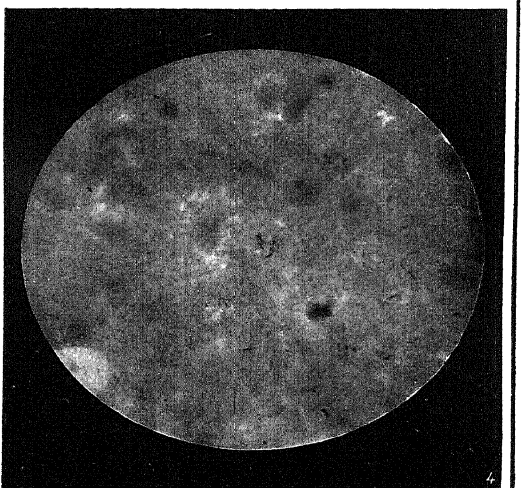
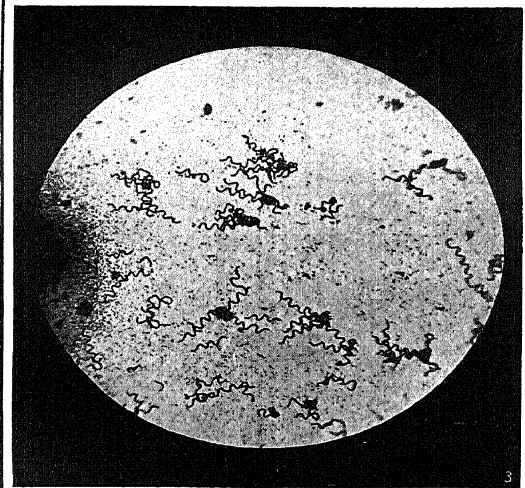
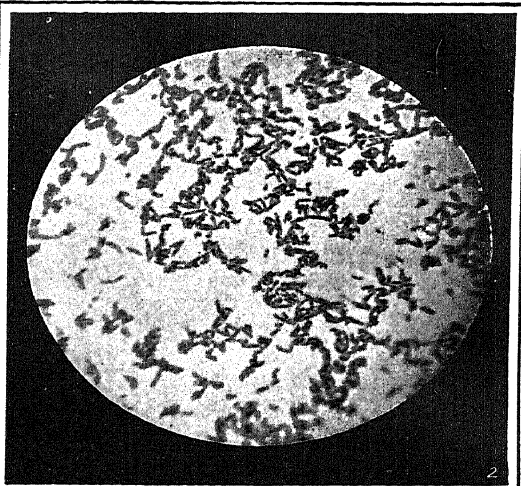
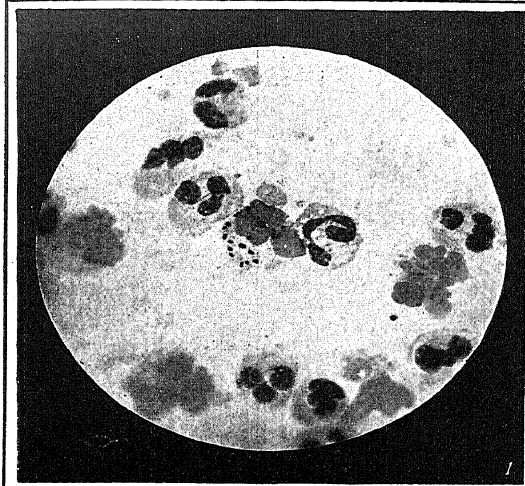
question and an account of a family of malingerers, consult Bailey, *Diseases of the Nervous System Resulting from Accident and Injury* (New York, 1906).

**DISEASE, GERM THEORY OF.** The theory that several enthetic diseases are caused by entrance into the body of germs of a vegetable nature, which during their growth produce chemical changes and give rise to chemical products. These chemical products, like other poisons, alter functions, disturb the processes of nutrition and repair, and cause disease. The germ theory, in a less accurate form, was proposed by a few investigators as early as the seventeenth century. (See BACTERIA.) Van Leeuwenhoek's discovery and description of the microorganisms which his imperfect optical instruments brought into view interested Lange and Hauptmann, who theorized at once on the important rôle the misnamed "animalcules" might play in the production of disease. Among the maladies which they considered to be probably due to *contagium animatum* were epilepsy, gout, pleurisy, typhus fever, measles, smallpox, and puerperal fever. In 1701 Andry and Linné announced that syphilis has a similar origin. Lancisi, in 1718, made a parallel claim for malaria. Following these most valuable deductions and theories came the publication, in 1702, of the results of the investigations and deductions of Antonius Plenciz, a Viennese physician, who declared that all infectious diseases were caused by microorganisms, and that the infective material consisted of either minute living animals or plants, letting a flood of light upon the whole subject through these brilliant discoveries of the truth. He stated his belief that differences in the length of the period of incubation of diseases were due to differences in the time of development of special germs, as they multiplied in the body. He suggested the conveyance of germs through the air. He made original investigations into the nature of the processes of putrefaction and fermentation, and stated, as a conclusion reached by his deductions, that such processes result from the presence, growth, and multiplication of living organisms. Following the publication and discussion of these statements arose the theory of spontaneous generation of minute animal and vegetable organisms, advocated by Needham, in 1749, after loosely conducted experiments. Bonnet, in 1762, Lazarus and Spallanzani in 1769, Schultze in 1836, Schwann in 1837, Helmholtz in 1843, Schroeder and Von Dusch in 1854, Hoffmann in 1860, Chevreul and Pasteur in 1861, all contributed results of accurate scientific experiments which showed the absolute falsity of the theory of spontaneous generation. But, incredible as it may now seem, it was not till 1876 that the combined results, philosophical, chemical, and biological, of Tyndall and Cohn set the question at rest and established the fact that "all life comes from life," to use the words of Harvey's law. About 1873 the germ theory of disease was authoritatively restated, and germ causation became an accepted principle.

**Germs in the Body.** The question as to how germs enter the body and the means of defense against them which the body possesses is one of extreme importance. When we think of the omnipresence of germs, in the air we breathe, in the water we drink, in much of the food we eat, in the soil upon which we walk, in fact in or upon almost everything we touch or with

which we come in contact, the question why bacteria do not oftener enter the body tissues would seem to be more rational than why they sometimes do so enter. Fortunately most germs are harmless, but many are capable of producing the most severe forms of disease. There are constantly present in the mouth, nose, and upper air passages, as well as throughout the entire gastrointestinal canal, microorganisms which under ordinary conditions are perfectly harmless. Then, too, the body is so built as to offer very powerful resistance to the entrance into it of most germs. First in importance of the body defenses against germ invasion is the skin. The unbroken skin offers an almost impassable barrier to the passage of most forms of germs. Being the most exposed, it is also the strongest of the body defenses against the entrance into it of microorganisms. Few, if any, germs have the power to penetrate it, if healthy and intact. Any person accustomed to dissecting, operating, or performing autopsies with ungloved hands, noting with what impunity highly infectious material may be handled provided there is no broken surface, and how serious are often the results of an overlooked wound or a chance scratch, realizes the importance of the skin as a protection against germs. There are, however, certain normal openings in the skin. These are: (a) those of the digestive tract—the mouth and anus. . . . . with the . . . . . stomach, . . . . . rectum; (b) . . . . . the respiratory tract, the mouth and nose—leading into the larynx, trachea, bronchi, and lungs; (c) those of the genitourinary tract, the urethra and vagina—leading to the bladder, ureter, kidney, uterus, and Fallopian tubes; (d) the eye. These openings and tracts are lined by mucous membranes which may be considered as forming a second line of defense against germ invasion. Being less exposed than the skin, the mucous membranes are also less resistant than the skin to the entrance of germs. Indeed, to certain species of germs the mucous membranes are especially susceptible; as the mucous membrane of the intestine to the bacillus of typhoid fever, that of the respiratory tract to the diphtheria bacillus and to the bacillus of pneumonia, and that of the genitourinary tract to the gonococcus. To a great many of the most dangerous species of germs, however, the healthy mucous membrane, like the unbroken skin, presents an impassable line of defense. Nor is the body helpless against the activities of germs even after they have entered its tissues. While the lymphatic system often furnishes the channels by means of which germs are carried from one part of the body to another, the lymphatic glands themselves undoubtedly act as filters arresting the progress of the germs, while the lymph cells probably possess certain germ-destroying powers. Then, too, the white corpuscles of the blood are endowed with properties which enable them to take up germs and destroy them. It is largely for this purpose, in all probability, that the white blood corpuscles leave the vessels and pass out into the surrounding tissues in inflammatory conditions. Certain other cells probably possess this same power of destroying germs. Such cells are known as *phagocytes*, and the process of germ destruction by them is called *phagocytosis*. There are also developed in the body during the progress of germ infections certain substances which appear to be in solution in the

# DISEASE GERMS



1. GONOCOCCUS In Pus Cells (Jenner Stain; F. C. Wood).
2. BACILLUS KLEBS-LOEFFLER OF DIPHTHERIA (Sulphuric Acid; Iron Alum, Haematoxylin; Leaming).
3. BACILLUS TYPHOSUS with Flagella (Van Ermengen's stain).

4. BACILLUS TUBERCULOSIS in Sputum (Eosin, Methylene blue).
5. STREPTOCOCCUS PYOGENES in Chains (Sulphuric Acid, Iron Alum, Haematoxylin; Leaming).
6. PNEUMOCOCCUS in Capsules (Copper Sulphate Method of Hiss).



fluids of the blood. These substances are known as antitoxins (q.v.) and have a distinctly inhibitory effect on the further development of the germs.

The effects upon the body mechanism of the activities of disease-producing germs vary, of course, greatly for the different germs. Certain general modes of action may, however, be mentioned. 1. The direct (usually local) effect of the presence of the germs. Thus, in diphtheria the direct local effect of the germ in the throat is death of parts of the mucous membrane and the formation of what is known as a false membrane. In a similar manner the ulcers in the intestines in typhoid fever are due to the direct local action of the typhoid bacillus. Another local effect which germs may sometimes have consists in the formation of infectious emboli in different parts of the body. Thus, e.g., in infectious endocarditis with bacterial growth in the heart valves, a little mass of bacteria may become detached and carried through the circulation until it reaches a vessel too small for it to pass through. Here it stops, forming an infectious embolus and thus setting up a new focus of infection. 2. The production of toxins (q.v.). These are poisons produced in the body by the activities of bacteria. They seem to be largely present in the plasma of the blood and are consequently distributed throughout the body. It is to these toxins that the systemic symptoms of an infectious disease are due, e.g., the fever, prostration, delirium, etc. These toxins differ for different bacteria, a particular toxin probably being specific for each species of germs. That a disease may be accepted as positively proved to be of germ origin, it must fulfill certain very rigid conditions. One single species of germ must always be found present in the diseases. This germ must not be found regularly in connection with any other disease. It must be possible to cultivate this germ artificially and to separate it in what is known as a pure culture, i.e., a growth of this germ absolutely free from any other living substance. It must be possible to induce the same or a similar disease in animals by injecting them with this pure culture. Comparatively few diseases as yet fulfill all of these requirements. Among the most important of the diseases which have been proved to be of germ origin may be mentioned anthrax, actinomycosis, Asiatic cholera, bubonic plague, acute cerebrospinal meningitis, diphtheria, erysipelas, glanders, gonorrhoea, influenza, leprosy, malaria, pneumonia, relapsing fever, syphilis, infantile spinal paralysis, tetanus, tuberculosis, and typhoid. Of the more important of the diseases which from their behavior are believed to be of germ origin, but in which the germs have not as yet been found, are hydrophobia, measles, scarlet fever, small-pox, typhus, a

**Bacteriologic.** In many cases of disease a species of bacteria present may be made by means of a bacterial examination of the material during life. This is done in three ways: first, by cover-glass preparation; second, by culture; third, by animal inoculation. In some cases a little pathological material may be obtained on a sterilized platinum loop; in others a piece of absorbent cotton wound about a stiff wire and forming a "swab" is used, by means of which pus or exudates may be obtained and transported in a sterile test tube into which the

swab is thrust; in still other cases fluid material may be obtained by aspiration. A cover-glass preparation is thus made: A very small amount of material is smeared over a cover glass in such a way as to leave streaks of it and not a continuous layer. After being dried by being held in the fingers, charged side uppermost, over a Bunsen burner, it is passed rapidly three times directly through the flame of the burner by means of a forceps, to "fix" it. The cover glass is then held in the grasp of the forceps, charged side up and level, and the chosen staining fluid is dropped on it from a dropping bottle till it is completely covered. The cover glass is then heated over the flame and washed in water, and any other necessary processes are concluded, according to the method of staining employed. The cover glass with the charged side down, and wet thoroughly with water, is placed on a microscopic slide, and the excess of water is removed by means of filter paper in the usual way. An oil-immersion lens is then used, for examination of the specimen.

Culture mediums differ in different cases. Potato, agar-agar, litmus milk, glucose agar-agar, and glucose gelatin are used; but the best culture medium for general purposes is coagulated blood serum. At the slaughterhouse blood is obtained as it runs from the vessels of the beeves, preferably that which flows from the carotid artery, as it clots more quickly. The jar in which it is received is left in a cool place for 24 hours. After a few hours the clot is gently loosened from the sides of the jar, to facilitate its contraction, and after this the jar is not agitated. After about 24 hours the serum is removed with a pipette. Three parts of blood serum and one part of glucose bouillon are mixed to form the culture medium, which is run into test tubes in small quantities. The tubes are placed in a tilted position in the hot-air sterilizer, and when withdrawn the serum is found to be coagulated in a slanting position. Material obtained on a "swab," e.g., from the throat of a suspected diphtheria patient, is lightly smeared over the whole exposed surface of the blood serum in a culture tube. The culture tube is then placed in an incubator or thermostat, and the bacteria are allowed to grow on the nutrient surface, for subsequent examination with the microscope.

Animal inoculations are made as follows: A small piece of suspected material may be inserted under the skin of a mouse by means of a platinum wire, or a little fluid may be injected under the skin of a guinea pig or rabbit. After the death of the animal an autopsy is made, and various organs and tissues are examined microscopically.

**Special Examinations.** In examining sputum for tubercle bacilli, a cover-glass preparation is made from a dense grayish-white particle taken from the morning sputum. The tubercle bacillus is a slender rod varying from 1.5 micromillimeters to 4 micromillimeters in length, and about 0.4 micromillimeter in breadth, generally slightly curved. The bacilli occur singly, though in cultures they are sometimes found in chains of four to six links. Clublike forms and branches have been seen also. It must be differentiated from the smegma bacillus and others. In examining for the bacillus of diphtheria a blood-serum culture tube is inoculated by means of a swab with exudate from the tonsils of the patient and is placed in the incubator for about

15 hours. The resulting growth is mounted on a slide and examined with a high-power lens. The bacilli will be found to be of varying size, from 1 to 6 micromillimeters long and 0.5 to 1 micromillimeter broad, straight or slightly



SPUTUM CONTAINING TUBERCLE BACILLUS ( $\times 1000$ ).

curved, with rounded ends, singly or in pairs. For the detection of the plasmodium of malaria, a fresh specimen of blood is taken from the lobule of the ear, spread on a cover glass, and inverted on a slide so as to spread the specimen evenly. Fixation may be secured by heating, or by immersing in a mixture of absolute alcohol and ether. The preparation is stained to secure contrast between the parasite and the blood disks. Under the microscope the plasmodia appear about the size of red blood corpuscles, discoid, star-shaped, in odd forms with prolongations, flagellae, and branches, nucleated, granular, etc. If not fixed, the parasites show rapid amoeboid movements in a fresh preparation. Other micro-organisms are described under the



DIPHTHERIA BACILLUS FROM TRACHEA ( $\times 500$ ).

titles of the diseases they cause. Consult: Friedländer, *Mikroskopische Technik* (Berlin, 1900); Thoma, *Lehrbuch der pathologischen Anatomie*, trans. by Bruce (London, 1896); Abbott, *Principles of Bacteriology* (Philadelphia, 1909); Mallory and Wright, *Pathological Tech-*

*nique* (ib., 1913); Sternberg, *Bacteriology* (New York, 1901); Newman, *Bacteriology and the Public Health* (Philadelphia, 1904); Muir and Ritchie, *Manual of Bacteriology* (New York, 1913); Ball, *Essentials of Bacteriology* (Philadelphia, 1913). See BACTERIA; MICROSCOPY; MALARIA.

**DISEASES OF ANIMALS.** In the general discussion of the diseases which affect animals various systems of classification have been adopted by different writers. The scheme here presented is that most commonly adopted. Animal diseases may be grouped under the following five heads: (1) infectious; (2) poisoning; (3) constitutional; (4) organic; and (5) diseases caused by animal parasites. Infectious diseases are due to the action of minute organisms in the blood or vital organs and tissues. Such diseases may be communicated from one animal to another by means of infected blood, by tissues, or by animal secretions containing the disease-producing organism.

The most important infectious diseases of animals are abortion, actinomycosis, contagious agalactia, anthrax, asthenia, blackleg, braxy, cattle plague, cerebrospinal meningitis, dog distemper, foot-and-mouth disease, fowl cholera, glanders, hog cholera, influenza, contagious pleuropneumonia, rabies, roup, swine plague, tetanus, Texas fever, and tuberculosis. Each of these is discussed in a separate article.

Under diseases of poisoning are included cases of poisoning of an acute or chronic nature by mineral, plant, or animal poisons. The more common mineral poisons to which animals may gain access are compounds of arsenic, lead, copper, zinc, phosphorus and mercury, mineral acids, and caustic alkaline substances. Among plant poisons mention may be made of strychnine, opium, aconite, and various wild plants, such as water hemlock, larkspur, loco, veratrum, death camas, and lupine. The eating of large quantities of ergot produces the symptoms of ergotism (q.v.). Smuts and molds sometimes cause digestive disturbances of a more or less serious nature. Animal poisons include snake poison, bee stings, stings of certain other insects, arachnids and nematodes, such as the buffalo gnat, ticks, ascarids, etc.

Diseases caused by animal parasites include those which are produced by parasitic worms, insects, mites, etc. Every species of domestic animals is infested to some extent with parasitic round or flat worms. The lung and stomach worms (q.v.) of sheep are periodically the cause of great losses to the sheep industry. The fluke worm, which causes liver rot (q.v.) of sheep and other animals, is of great economic importance. The nodular disease of fowls is due to the presence of tapeworms in the walls of the intestines. Trichinosis of hogs is due to infestation by the round worm (*Trichinella spiralis*). Beef and pork measles are conditions produced by the presence of tapeworms in an immature condition in the meat. The kidney worm, which usually lies imbedded in the fat tissue of the loins of hogs, occasionally penetrates the kidney and causes death. Besides the examples already given, there is a considerable variety of round and flat worms which infest the intestines of domestic animals without causing any marked disturbance except when present in unusually large numbers.

Nearly all domestic animals are subject to mange or scab. This disease is due to the at-

tacks of various species of mites. One species with several varieties causes one form of scab on sheep, cattle, horses, and goats. A few species of flies live, during a portion of their life cycle, as parasites on or in animals. Chief among these are the horse botfly, sheep botfly, ox warble fly, and screw-worm fly. The last three occasionally cause serious disease. Others, such as the stable fly, horn fly, and tabanids, are a source of great irritation and annoyance as well as of depletion through the removal of blood. Various species of ticks and fleas are well-known pests on domestic animals. Many parasites are of primary importance because of their agency in the transmission of disease-producing micro-organisms, either by mechanical conveyance or through serving as an intermediate host in which some development of the disease-producing agent takes place. Important among such parasites are the ticks, which are true intermediate hosts of the Texas fever and other organisms, and certain flies which convey trypanosomes which cause surra and other diseases.

Under the head of constitutional diseases reference is ordinarily made to such pathological conditions as anæmia, scurvy, and diabetes, which occasionally prevail in animals as well as in man.

The term "organic diseases" includes diseases of the skin, digestive organs, respiratory organs, circulatory organs, nervous system, and urogenital organs. Some of the numerous diseases which fall in this category are infectious.

It will be understood that the system of classification here proposed cannot be followed too strictly and that the different categories are not mutually exclusive. The various forms of scab and itch may readily be transmitted from one animal to another by contact and are therefore contagious. The terms "infection" and "contagion," however, usually have reference to diseases which are due to the action of bacteria, protozoa and filterable viruses. Of the chief infectious diseases of animals, actinomycosis, anthrax, glanders, foot-and-mouth disease, rabies, tetanus, and tuberculosis may be transmitted to man. Consult: N. S. Mayo, *Diseases of Animals* (5th ed., New York, 1910); J. Law, *Text-Book of Veterinary Medicine*, 5 vols. (Ithaca, N. Y., 1905-11); E. W. Hoare, *A System of Veterinary Medicine*, 3 vols. (Chicago, 1913); Huttyra and Marek, *Special Pathology and Therapeutics of the Diseases of Domestic Animals*, 2 vols. (New York, 1913).

**DISEASES OF PLANTS.** In addition to being of great scientific interest, diseases of plants are of immense economic importance. Losses running into millions of dollars have been caused in different countries by certain plant diseases. In Australia the wheat rust often greatly depreciates the wheat crop; phylloxera has ravaged the vineyards of France; potato rot is held partly responsible for some of the famines in Ireland; mildew and black rot are serious enemies to grape culture in America, and in parts of California grape growing has been abandoned on account of disease. While the occurrence, though not the causes, of many plant diseases has long been known, their definite study (phytopathology) has been developed since about 1885. Since that date our knowledge of the causes of diseases and of the means of preventing them has been growing with remarkable rapidity, and no country has added more to this information than the United States,

through the plant pathologists of the Department of Agriculture and of the several agricultural experiment stations.

For ordinary purposes, plant diseases may be classified, according to their causes, into four categories, viz.: (1) those caused by fungi; (2) those caused by bacteria; (3) those due to nematodes and insects; and (4) those due to physiological causes.

Taking these in the order of enumeration, the diseases due to fungi are given first rank, and they are perhaps the most widely spread and destructive of all. There is hardly a crop or a species of plant that is not liable to attacks of fungi through either its roots, stem, leaves, or fruit. The spores of fungi are exceedingly minute, and through them disease is spread. They are carried everywhere by the wind, by insects, and other means. Finding lodgment upon a plant, if the conditions are favorable, it is attacked. Plants not in perfect physical and physiological condition offer an easy entrance to the germ tube sprouted from the spore, and the threadlike mycelium spreads the disease through the host plant, as it is called, the fungus being referred to as a parasite. All plants are not subject to the attack of the same fungi, since certain conditions render a given plant immune to some and susceptible to others; nor are all fungi parasitic, since some live usefully as saprophytes upon dead and decaying vegetation. Some fungi gain entrance to plants by sending their germ tubes through the minute breathing pores of the leaves; others dissolve their way through the cuticle by means of ferments which they secrete. Still others known as wound fungi can gain entrance only through some wound on the host plant, entrance having to be prepared for them. Once the host is attacked and the conditions of temperature and moisture favorable, the disease progresses with great rapidity, from individual to individual, and becomes a veritable epidemic. The host plant is injured in a number of ways, such as being robbed of its nourishment, having its water supply shut off, etc. Some parasites stimulate the host to unusual growth, as may be seen in the galls, knots, and other growths of which are of grotesque shapes. Others produce stunted growth or destroy the host plant entirely. Many fungi which cause plant diseases are interesting on account of the fact that they exist in two forms, each of which lives upon a different plant. The phases which belong to one cannot be made to grow upon the other, but the phases of each host readily inoculate the other. This is true of the fungus causing apple rust, the alternate form of which is found in the so-called apples of the red cedar or juniper. Different stages of one of the wheat rusts (*Puccinia graminis*) are found upon wheat and upon the barberry leaves. A disease of pine occurs in another form upon currant leaves, and many other similar examples are well known. Familiar examples of disease caused by fungi are the rusts and smuts of grains, potato rot, grape rot, clubroot, crown gall, plum knot, anthracnose of many plants, leaf spots, wilt diseases, mildews, scab, etc., all more fully described under the names of their respective hosts.

The second class of plant diseases to be considered are those due to bacteria, over some of which there has been considerable controversy. Some writers have denied their bacterial origin, but the investigations of Dr. E. F. Smith and



others seem to prove that in a number of well-known instances bacteria are the immediate cause of disease. These investigators by carefully conducted experiments have succeeded in producing the diseases in question by inoculation experiments with the bacteria. Diseases of fungus origin for the most part attack certain definite portions of plants, as the leaves, fruits, etc., destroying them and indirectly the rest of the plant; but the bacteria especially upon soft, herbaceous plants, attack any part of the plant and cause its sudden collapse without much delay. Prominent among the diseases attributed to bacteria may be mentioned the fire blight of apples and pears, crown gall of many plants, black rot of cabbage, a wilt disease of cucumbers and melons, a brown rot of potatoes, eggplant, and tomatoes, a disease of sweet corn, a hyacinth disease, and a disease of celery. Most of these are fully characterized under their special names.

Among the diseases of the third class may be mentioned the phylloxera, which attacks the roots of the grape, devastating the vineyards of France, Italy, Germany, and Europe generally, wherever varieties of grapes which belong to *Vitis vinifera* are grown; nematodes, or eelworms, which attack the roots of many plants in parts of the United States, Europe, and elsewhere, causing galls to be formed to the great detriment of the plant; and thrips and aphides, whose punctures cause a disease of carnations and doubtless many other plants.

The diseases of the last class are due to some interference with the proper exercise of the functions of the plant—by improper nutrition, too much or too little water, light, heat, etc. These functional diseases manifest themselves in a manner similar to the bacterial diseases, the whole plant being affected. For these diseases the corrective means suggest themselves, the only discovery of the causes.

The discovery of the past few years have led to the discovery not only of the causes of many plant diseases, but also of the means whereby they may be prevented. Cures are not known for such diseases when the plant is once badly affected, so attention is given to their prevention. Sanitary conditions are necessary to keep plants in a healthy state. In order to prevent the spread of plant diseases all affected plants and parts should be collected and burned. All weeds and wayside plants likely to harbor the disease should be destroyed. Many diseases are spread by insects, and, as far as possible, these should be destroyed. Many diseases may be prevented by the use of fungicides and repeated spraying of them. The theory upon which these are based is that the copper or other substances used are detrimental to the germination of the fungus spores by which the diseases are spread. Experience has shown that much of the loss due to some of our most common and destructive plant diseases might have been absolutely prevented by the timely and thorough use of fungicides, and that at a cost very small indeed compared to the loss sustained.

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1910); Prillieux, *Maladies des plantes agricoles* (2 vols., Paris, 1895-97); Smith, *Bacteria in Relation to Plant Diseases* (2 vols., Washington, 1905, 1911); Freeman, *Minnesota Plant Diseases* (St. Paul, 1905); Faes, *Les maladies des plantes cultivées et leur traitement* (Paris, 1909); Delacroix and Maublanc, *Maladies des plantes cultivées* (ib., 1909); Stevens and Hall, *Diseases of Economic Plants* (New York, 1910); Stevens, *The Fungi which Cause Plant Diseases* (ib., 1913); Duggar, *Fungal Diseases of Plants* (ib., 1909); Delacroix, *Maladies des plantes cultivées dans pays chauds* (Paris, 1911); Eriksson, *Fungoid Diseases of Economic Plants*, trans. by Anna Molander (London, 1912). See FUNGICIDE; FUNGI, ECONOMIC.

**DISENTIS**, dē'zen-tis. A village in Switzerland, Canton Grisons, situated 34 miles southwest of Chur and 3600 feet above sea level (Map: Switzerland, C 2). It is the site of a large Benedictine monastery, founded in 614 by the Scottish monk Sigisbert. Pop., 1900, 1400; 1910, 1691.

**DISFRANCHISEMENT**. See SUFFRAGE.

**DISHONOR** (ML. *dishonor*, from Lat. *dis-*, apart + *honor*, honor) OF NEGOTIABLE PAPER. The refusal or failure of the drawee of a bill to accept, or of the acceptor of a bill or the maker of a promissory note to pay it at the proper time. If the drawee of a bill of exchange refuses to accept it when duly presented, the holder is bound to give notice at once to the drawer and indorsers, or he will relieve them from liability on the paper, as a rule. Ordinarily the drawer of a bill of exchange or a check has funds in the drawee's hands, upon which the bill or check is drawn, and if the drawee refuses to honor the bill or check, the drawer is entitled to notice, so that he may withdraw his funds. If a banker dishonors a customer's check by refusing to pay it when the customer's account is good for it, he makes himself liable in damages to the customer, for such an act tends to harm the latter's credit. See NEGOTIABLE PAPER, and consult the authorities there referred to; see also BILL OF EXCHANGE; CHECK; PROMISSORY NOTE; PROTEST.

**DISINFECTANTS** (from *dis-*, without + Eng. *infect*, from OF., Fr. *infecter*, from Lat. *inficere*, to infect, from *fr.* in + *facere*, to make). A class of substances which have the power of destroying the causes of infectious and contagious diseases. In a large proportion of these diseases the causes have been found to be microorganisms of a vegetable nature, called bacteria (q.v.). In the rest of these diseases such microorganisms are supposed to exist, but have not yet been identified. Disinfectants are used to destroy these germs or to stop infection. The term "deodorants" is applied to substances that dissipate or destroy foul smells, but do not necessarily destroy germs; and the term "antiseptics" is applied to substances that prevent the growth especially of those bacteria which cause fermentation or putrefaction of dead tissue, or suppuration in the living body. A disinfectant may act in one of several ways. It may oxidize the offending material, or neutralize the activity of the latter by albuminous combination, or it may alter the reaction of the surrounding media, rendering it unfavorable for the development of germs.

All clothing and bedding, curtains, carpets, etc., which cannot be burned immediately and which ought to be disinfected should be kept



moist until completely sterilized, for the bacteria and their spores are easily scattered in the dust arising from handling dry articles. The mucus coughed up by tubercular patients readily pulverizes and mixes with the dust when dry, thus endangering any one who may inhale the dust-laden air of an infected room. All dust which has settled in cracks, on woodwork or furniture of an infected room, should be removed by wiping it up with cloths wet with a solution of bichloride of mercury and water, 1 to 1000, or a 3 per cent solution of carbolic acid in water; and the cloths should be burned afterward. The same solution may be used in washing all walls and woodwork. Boards of health advise that apartments, after being thus treated, should be fumigated with sulphurous acid, that all cracks may be thoroughly permeated by a disinfectant. For each 1000 cubic feet of space four pounds of sulphur is placed in an iron pan, which is placed upon a brick, which, in turn, stands in a tub of water. Vessels of boiling water are placed about the room. The sulphur is then lighted and the room closed air-tight. This method may have some value in cases of smallpox, scarlet fever, and measles, but it does not kill the germs of diphtheria, anthrax, or tuberculosis, and is being abandoned. Formaldehyde gas has been employed increasingly as a disinfectant since 1893, as generated by special apparatus from formalin pastilles. Two grams of formalin for every 35 cubic feet of room space has destroyed anthrax, tubercle, diphtheria and typhoid bacilli, streptococcus, and other bacteria in a few hours. Formaldehyde does not injure clothing, fur, paper, leather, photographs, or rubber or metal goods. Sanitarians advise the disinfection of dwellings, carpets, bedding, clothing, and upholstery with formaldehyde, and advocate this agent for disinfection of ambulances and other conveyances which can be tightly closed, the gas to be used in the proportion of 10 per cent by volume, the time of the exposure to be not less than one hour.

Surgeons' instruments are disinfected (or, rather, sterilized) by boiling them in water containing 2 per cent of bicarbonate of soda, by passing them through the flame of an alcohol lamp just before use, or by exposing them to formaldehyde gas. The latter does not dull keen edges. Surgeons' hands and arms are sterilized by washing with soap or green soap and nail-brush, and then with a solution of permanganate of potash or of bichloride of mercury. The faces of typhoid and cholera patients, and the sputa of patients suffering with tuberculosis, influenza, pneumonia, etc., should be disinfected with a 5 per cent solution of fresh chloride of lime or a 5 per cent solution of crude carbolic acid. Either of these disinfectants is useful in disinfecting privy vaults or accumulations of sewage. Peroxide of hydrogen is used in disinfecting suppurating wounds in some cases. Chloride of zinc and chlorine gas, as well as certain patented coal-tar derivatives are used in special cases for disinfection.

**Heat and Cold.** It must be remembered that the best disinfectant of all is heat. Articles of clothing that can be washed are easily disinfected by the use of boiling water. Other articles may be subjected to baking, or to sterilizing by the use of steam under pressure. Ovens called sterilizers are arranged in hospitals, into which steam at a temperature of about 225° F. is admitted under pressure for the treatment of

clothing and bed coverings. Similar cylinders are constructed for the use of health departments in large cities. Cold kills the bacteria of yellow fever, but not those of anthrax, smallpox, or typhoid fever. Consult Rosenau, *Disinfection and Disinfectants* (Philadelphia, 1902), and Christian, *Disinfection and Disinfectants*, trans. by Salter (London, 1913). See ANTISEPTIC; BACTERIA; CONTAGION; INFECTION; DISEASE, GERM THEORY OF.

**DISINFECTION.** See DISINFECTANTS.

**DISK** (Lat. *discus*, Gk. *δίσκος*, *diskos*, disk). A word of various application among plants. Among Compositæ (sunflowers, asters, etc.) it refers to the central part of the head in which the showy corollas do not occur as at the margin. In other groups it refers to a ringlike structure developed within the flower, from which certain of the floral parts often arise; or to a disklike structure upon the top of the ovary in certain epigynous flowers. See FLOWER.

**DISKO.** See DISCO.

**DISLÈRE**, de'slâr', PAUL (1840- ). A French engineer and administrator, born at Douai. He studied at the Ecole Polytechnique and in 1861 entered the naval engineers. In 1888 he became an engineer of the first class. From 1868 to 1871 he was in charge of the arsenal at Saigon, French Indo-China; in 1881 was appointed Councilor of State; and in 1882 received the post of Colonial Director in the Ministry of Marine. He was transferred in 1891 to the directorship of foreign commerce. He was one of the presidents of the Universal Exposition in 1900. His *Traité de législation coloniale* (1886) is regarded as authoritative. His works further include: *La guerre d'escadre et la guerre des côtes* (1876); *Etudes de statistique*; *Les budgets militaires de la France et de l'Angleterre* (1878); *Le service militaire aux colonies* (1889; 1899).

**DISLOCATION** (Fr. *dislocation*, from ML. *dislocare*, to dislocate, from Lat. *dis-*, apart + *locare*, to place, from *locus*, place). A displacement of one bone from another with which it forms a joint ("put out of joint" being the popular expression). Dislocations are generally the result of accident, but may also be the result of disease or may be congenital. The displacement may be partial or complete. In the former their cases into simple and compound. In the former the skin remains unbroken, and compound when there is a wound by which the external air may communicate with the joint. Occasionally, in addition to the dislocation, there are fractures of the bones, or lacerations of important blood vessels in the joint. In the former the dislocation is then said to be compound. Dislocation is rare in infancy and in old age; in the former the joint ends are very flexible and yield to violence, while the aged skeleton is so rigid that the brittle bones fracture under force that would drive the younger and firmer ones out of their sockets. Dislocations are most frequent between 30 and 60. Persons with weak muscles and lax ligaments, or those in whom the latter have been softened by inflammation of the joint, are predisposed to dislocation. The joints most frequently displaced are the shoulder and the elbow.

**General Symptoms.** After a blow, fall, or violent muscular exertion, a limb is found to be immovable at the injured joint; there is great pain, and the shape of the part is changed; but soon swelling ensues, and every distinctive mark

about it is obscured. If left alone, or merely treated as an inflamed joint, the swelling gradually subsides, but the immobility continues, the limb is crippled for months or years, until nature forms a new socket for the end of the bone.

**Treatment.** This consists in reduction or replacement of the bone into its original position. Its return is opposed by the muscles attached to it, which are stimulated to contraction by the pain of the operation, the latter requiring at times the application of considerable force. Reduction is accomplished by two methods—manipulation and traction. In the former the surgeon endeavors first to relax those muscles which prevent the return of the head of the bone into its proper position, causing the bone to retrace the path by which it escaped from the socket. When manipulation is unsuccessful, the attempt is made to overcome the resisting power of the muscles by traction. When this is fully done, the bone usually slips easily into its place, with some guidance from the hand of the surgeon. Violence in traction, however, must never be used, as injury to surrounding tissues, or fracture, may result. In some cases anæsthesia must be resorted to in order to produce complete muscular relaxation.

The subsequent treatment consists in rest, with splints or bandages to prevent a recurrence of the dislocation while the rent in the joint capsule is healing. Four to six weeks are usually necessary for the accomplishment of this process. The treatment of congenital and pathological dislocation is palliative and requires the use of some special apparatus, although at times operation may give a new and serviceable joint.

**DISLOCATION (IN GEOLOGY).** See FAULT. **D'ISLY, DUC.** See BUGEAUD DE LA PICONNERIE.

**DISMAL SWAMP.** A swamp having an area of about 750 square miles, lying chiefly in Virginia and partly in North Carolina (Map: Virginia, H 5). Approximately in its centre is Lake Drummond, about 2 miles in diameter, very shallow and lying about 10 feet above the level of the Elizabeth River at Norfolk, Va. Elsewhere the surface is covered with tangled weeds and heavy timber, with a thick undergrowth. A canal crosses the swamp, opening between Elizabeth City, N. C., and Albemarle Sound and Chesapeake Bay. Much of the swamp's area has been reclaimed. The area was originally about 2200 square miles but has been reduced by drainage and cultivation to that above named, 750.

**DISMANTLED** (from *dis*, without + *man-* *tle*). The state of a ship when unrigged and after her guns, stores, etc., have been taken out. When men-of-war were built of wood, they were, if not recommissioned, after completing a cruise, dismantled; in that condition, with hatches and other openings closed, they were secured alongside a navy-yard wharf, and this was called being laid up *in ordinary*. Modern ships are not dismantled, except for repairs. They deteriorate very much faster than wooden ships, and it is vastly more expensive to dismantle and reëquip them.

**DISMAS, SAINT.** The name which tradition has attached to the one of the two malefactors crucified on either hand of Jesus who repented. He is represented with a cross beside him. The impenitent malefactor is called Gesmas. Both names are highly improbable.

**DISON, dē'zôn'.** A town of Belgium, in the Province of Liège, situated about 2 miles north west of Verviers, on a railway line. It has extensive woolen and cotton mills and stone quarries. Pop., 1900, 12,355; 1910, 11,434.

**DISOWNED, THE.** A novel by Bulwer-Lytton (1829).

**DISPART'** (from Lat. *dispartire*, *dispartire*, to divide, from *dis*, apart + *partire*, to divide, from *pars*, part). The difference between the semidiameters of the parts of the gun on which the sights are placed (if on the gun itself). The term is practically obsolete, as sights are now placed on the mount and not on the gun, but it was formerly of great importance.

**DISPENSARY** (Fr. *dispensaire*, from ML. *dispensarius*, from *dispensa*, larder, from Lat. *dispensare*, to disburse, from *dis*, apart + *pensare*, frequentative of *pendere*, to weigh). An institution in which medical or surgical treatment is given free of charge to patients who are able to walk in and then return home, no beds being provided as in a hospital. In 1687, at a meeting of physicians in London, England, it was resolved to supply the poor with medicines at certain fixed prices. Previous to this, aid and medical treatment were given to the poor at the houses of wealthy people or at monasteries. In 1696 the president, censors, and 50 members of the Medical College of London agreed to maintain a dispensary that should give medical aid to all who asked it, and a building was erected for the purpose, with rooms for seeing patients and dispensing medicines. Physicians were also appointed, who visited the sick poor in their homes. This building, the Royal General Dispensary, Bartholomew Close, London, was opened in 1770. The oldest dispensary in the United States, the New York Dispensary, was founded in 1790. In all cities and large towns in the Union dispensaries exist, supported by private charitable organizations or maintained as "outdoor poor" departments of county, city, or private hospitals. In some cases medicines are furnished gratuitously, but in most dispensaries in cities a charge of 10 cents is made for each medicine prescribed.

**Dispensary Abuse.** In all the large cities a great number of well-to-do people seek free medical aid. The blame for this condition appears to lie at the doors of the trustees and superintendents of the clinics and dispensaries, and sometimes at the doors of the physicians who practice in them. The college clinic is established for the purpose of securing material with which to illustrate the didactic lectures delivered by the professors and with which to teach medical students the appearances and conditions of disease. To give free medical aid to the poor is a secondary consideration. The applicant for free treatment at a college clinic or at a dispensary where the attending physician is allowed to teach private paying pupils with the illustrative aid of the patients, is quite as often admitted in silence as he is questioned about his ability to pay a fair fee for a physician practicing near his home. If the patient is asked, the patient is not always truthful, and it is a matter of common occurrence for patients to wear old clothing and give fictitious names and false addresses in order to avoid paying a physician the fees they are quite able to afford.

In accordance with a law passed April 18, 1899, a new régime was initiated in New York City on October 1 of that year. Since that date

each dispensary must be licensed by the State Board of Charities, and each applicant for a license must take oath that the dispensary is for the public benefit; no school of medicine is obligatory, but the board is empowered to examine every dispensary and revoke licenses of those not conforming to the law. A dispensary is defined to be any person, corporation, institution, association, or agent whose purpose it is, either independently or in connection with any other, to furnish at any place or places, to persons nonresident therein, either gratuitously or for a compensation determined without reference to the cost or value of the thing furnished, medical or surgical treatment, medicine or apparatus; provided that the moneys used by and for the purposes of the said dispensary shall be derived wholly or in part from trust funds, public moneys, or sources other than the individuals constituting said dispensary. Applicants for aid must sign a declaration of financial inability. Violation of the law is punishable by fine. The college clinics, however, seem to escape the control intended by the framers of this statute, because their purpose is to teach medicine to students. Consult: *Medical Memoir of the Central Dispensary in London, 1773 to 1774* (London, 1774); *A History of the Boston Dispensary* (Boston, 1859), and report of the same for 1911; *New York State Board of Charities: First Report of the Committee on the Abuses of Medical Charity* (New York, 1878), also similar reports for 1897 and 1905; Goldwater, *Dispensary Ideals: A Plan for Dispensary Reform* (Philadelphia, 1907).

**DISPENSATION** (Lat. *dispensatio*, from *dispensare*, to disburse). A term in ecclesiastical law to denote a relaxing of the law, by a lawful authority, in some particular case; more specifically a license granted by the Pope or some bishop relieving or exempting an individual in certain circumstances from the action of some law or regulation of the Church. In the Roman Catholic church, since at least Innocent III, the principle has been established that only the Pope can dispense from the operation of a universal law; but in certain cases he may depute this power to bishops and others. The dispensations known to the Roman canon law are divided into papal and episcopal, into dispensations of right and of favor, and (according to the public or secret character of the impediment to be removed) *pro foro externo* or *interno*. In cases of dispensation *pro foro externo* the authorization is through the administration bureau known as the Apostolic Dataria; in cases *pro foro interno*, through the Pœnitentiaria. Bishops may dispense from their own statutes or those of their predecessors; vicars general have the same power as bishops. Parish priests may dispense their own people from observance of fasting, abstinence, and holy days. Henry VIII assumed the ecclesiastical right of dispensation within the realm of England in 1534 and conferred it on the Archbishop of Canterbury in so far as it was not contrary to the law of God. The granting of special licenses for the performance of the marriage ceremony without publication of banns (q.v.) is the only form in which this power is now exercised by the Archbishop. The only form of dispensation now exercised by the bishop of the Church of England is granted to a clergyman to enable him to hold more benefices than one or to absent himself from

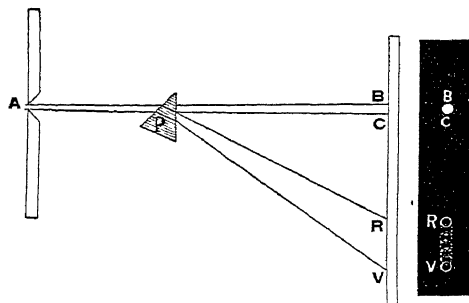
his parish. In the Protestant churches on the continent of Europe the right of dispensation from the operation of ecclesiastical law has in theory devolved upon the princes, who, however, generally exercise it through the consistories. See DISCIPLINE, ECCLESIASTICAL; INDULT; MARRIAGE.

**DISPERMINE.** See PIPERAZINE.

**DISPERSAL** (from *disperse*, from Fr. *disperser*, to scatter, from Lat. *dispergere*, to disperse, from *dis-*, apart + *spargere*, to scatter). In plants, the scattering of seeds, spores (including pollen grains), and even vegetative members. Hooked appendages, etc., are spoken of as dispersal adaptations. See SEED; POLLINATION; SPORE.

**DISPERSE SYSTEMS.** See COLLOIDS.

**DISPERSION** (Lat. *dispersio*, from *dispergere*, to disperse). It was shown by Sir Isaac Newton that, if a beam of sunlight entered a darkened room through a small round opening, *A*, and fell upon a prism of glass, *P*, the light on leaving the prism consisted of colored beams, each beam having a different direction, but merging into its neighbors. In-



DISPERSION — NEWTON'S EXPERIMENT.

stead of the beam of light falling on the screen at *BC* and making a bright round white spot, the rays after traversing the prism are divergent and produce the prismatic band seen at *RV*, the violet rays being bent or refracted the most. The colors thus observed form what is called a *spectrum*. (A better . . . is to have as the source of light a . . . to the edge of the prism, a plan also tried by Newton.) White light is thus dispersed into colors. The angle between the beams of any two colors is called the "dispersion" of those colors for the given conditions of material and shape of prism and of angle of incidence. Dispersion is due to the fact that ether waves of different wave numbers—and hence characterized by different colors if they are visible—travel in a material medium, e.g., glass, with different velocities, and therefore have different degrees of refraction. The "dispersion curve" of a given substance is a curve drawn . . . having wave length and index of . . . : bscissæ, showing how these two quantities are connected for the substance. Dispersion may also be caused by various interference and diffraction phenomena. Further, since dispersion is a characteristic of wave motion, the assumption being that some waves travel faster than others in a given medium, it may be observed with all kinds of waves in suitable media. See LIGHT.

**DISPLACEMENT** (from *displace*, from *dis-*, without + *place*, Fr. *place*, from Lat. *platea*,

Gk. *πλατεία*, *plateia*, street). The weight of an object determined by the amount of water it displaces, i.e., the weight of the water displaced. Formerly both men-of-war and merchant vessels were classed according to their tonnage (q.v.) measurement; and the latter still are, but the former are now classed by displacement as well as design. The displacement selected as a standard for each particular vessel is one in which the vessel is said to be at *mean load draft*. In theory it means that the average amounts of coal and other stores are on board; it is a purely arbitrary condition, however. The only condition in which vessels are justly comparable is with all coal and stores on board. In the United States and Great Britain the displacement of a ship is measured in tons of 2240 pounds; in countries using the metric system it is measured in tons of 1000 kilograms, or 2204.6 pounds.

**DISPLAYED** (from *display*, from OF. *despleur*, *desploier*, Fr. *déployer*, It. *dispiegare*, *spiegare*, from ML. *displicare*, to unfold, display, from Lat. *dis*, apart + *placare*, to fold). A term in heraldry denoting "expanded," and applied, e.g., to an eagle with wings outspread.

**DISPOSITION** (Lat. *dispositio*, from *disponere*, to dispose, from *dis*, apart + *ponere*, to put). The hypothesis of mental dispositions has been used in psychology to bring mental facts into an interconnected and coherent system. It is obvious that the conditions of many mental processes are not themselves directly accessible to introspection. When, e.g., a name is remembered, it is not always possible to point to the immediate conscious antecedents of the memory. Various hypotheses have been put forward to supply the missing links in the sequence of conscious processes. One hypothesis says that the mind has a "faculty" of remembering (see **FACULTY**); another, that the absent terms are to be explained as physiological factors, which are not themselves accompanied by consciousness, but which introduce conscious processes; a third hypothesis refers the matter to the "subconscious" (q.v.), i.e., to a lower stratum of consciousness, which escapes introspection; and, finally, coherence is brought into mental facts by an hypothesis which posits "mental" or "psychical dispositions." Bain has spoken of "the permanent products stored up in the mental organization" as "stores in reserve," the fruits of experience which may be conceived as lying outside consciousness and yet as affecting mental processes. Such a conception is based upon the fact that past experiences seem continually to color our present thoughts, emotions, perceptions, and actions. I hear a familiar voice, and immediately the face of a friend—as I last saw him, perhaps—comes before my mind. Evidently, if I had had no previous knowledge of the individual, the sound would not have "aroused" the visual image of his face. One may say, in this and similar cases, that the previous experience left a "persistent trace" which serves to revive the image.

The difficulty of the hypothesis lies in its inability to give any descriptive account of the conditions of consciousness which it supposes to exist. If one means by "psychical dispositions" a host of ready-made sensations, ideas, emotions, etc., which are not in consciousness, but which nevertheless exist, one is surely juggling with terms; for consciousness is involved

in the very notion of these processes. If, again, the disposition is neither mental nor material, it can only be an unknown condition which we may call *x*. The "physiological disposition" is therefore the best working concept. Experimental psychology, in investigating the conditions underlying the sequence of conscious processes, recently has found it necessary to speak technically of "tendency," and has thus given the term "disposition" a fairly specific meaning. The tendencies and dispositions are physiological in nature; every sensory or imaginal excitation leaves behind it a "trace" or "impression" in the nervous system, sets up according to its strength and diffusion what is called an "impressionable tendency"; every such excitatory process, moreover, tends to call up other like processes which have been associated to it (the "associative tendency"); and, finally, any particular train of associative tendencies may be guided by a determining tendency (q.v.). A "disposition" may now be described as a general set or state of the nervous system, from and within which both determining and associative tendencies may arise. Let us suppose, e.g., that an artist and a geologist are viewing the same landscape; each has a general disposition, a cortical set, a nervous bias, in part perhaps inherited and in part acquired. Consequently each has a rich field of associative tendencies, some of which we may imagine both men to possess in common, while others are separately conditioned upon the respective dispositions. Moreover, as a more direct result of the dispositions, each has a peculiar set of determining tendencies. The artist has, among others, a determination to paint pictures when they are suggested to him; the geologist, to judge the age of geological formations when some unusual bit of evidence is presented; the perception of a certain combination of color, therefore, may touch off the artist's determining tendency in such wise that he notes the hues and tints, the distribution of light and shade, the contour of the sky line, all in the sense of his particular end, while the same perception arouses in the geologist a determining tendency that culminates in a judgment of the age of the hills in the background. Both disposition and tendencies may, or may not, be represented in consciousness; and both consciousnesses, if present, are subject to the laws of growth and decay.

We have here spoken of disposition and of the various forms of tendency as if they were real characters. So in one sense they are: the nervous system behaves in certain definite ways, which we are in duty bound to recognize and name. But it must be remembered that our knowledge is altogether indirect, drawn from the results of psychological experiments. As to what actually goes on in the nervous system when we speak of disposition, or of associative and determining tendencies, we do not know. The physiological explanation is thus a problem for the future. Consult: Stout, *An Introduction to Psychology* (London, 1896); Wundt, *Grundzüge der physiologischen Psychologie* (Leipzig, 1910-11); Bain, *The Senses and the Intellect* (London, 1894); Titchener, *Text-book of Psychology* (New York, 1910).

**DISPUTATION** (Lat. *disputatio*, from *disputare*, to dispute, from *dis*, apart + *putare*, to think). An exercise of logical and dialectic skill in which one party advances an argument and the other seeks to refute it. Challenges

to such exercises were often issued—e.g., at Paris in 1577 by the “Admirable Crichton.” Memorable religious disputations were those between Knox and Kennedy (1562) and between Laud and Fisher the Jesuit (1623). The practice survives as an academic form in some of the German universities, where the candidate for the doctorate is obliged publicly to defend the thesis contained in his printed dissertation. Formerly this disputation was held in Latin, but in late years this practice has become rare.

**DISPUTATION OF BERN.** See BERN, DISPUTATION OF.

**DISRAELI**, dīz-rā'li or dīz-rē'li, BENJAMIN, EARL OF BEACONSFIELD (1804–81). An English author and statesman. He was born in London, Dec. 21, 1804, the son of Isaac D'Israeli, author of *Curiosities of Literature*, who belonged to a Jewish family. His education was carefully superintended by his father. In 1821 he was articled to a solicitor with a view to a government office, but, finding the study of the law unattractive, he withdrew his name from Lincoln's Inn in 1831. He had meanwhile become famous as an author, having published his book *Vivian Grey* in 1826. He continued his literary career and spent three years (1828–31) traveling in Spain, Italy, and the Levant. He was, however, more ambitious for political than for literary celebrity, and, after two unsuccessful attempts to enter Parliament as a Radical, he succeeded in entering as a Tory from Maidstone in 1837. Before this time his political pamphlets, especially his *Vindication of the British Constitution*, which Peel commended, had attracted wide attention. In the House his maiden speech was so much in the grand style and delivered with so many extravagant gestures that it excited ridicule. Much disconcerted, Disraeli stopped abruptly, making, however, the prophetic remark, “I shall sit down now, but the time is coming when you will hear me.” From this time on he studied carefully the style of successful parliamentary orators and propagated his political tenets in his novels, *Coningsby* (1844), *Sybil* (1845), and *Tancred* (1847). Looking towards the Stuart monarchy for inspiration, he held that the government from 1688 to 1832 had been a Whig oligarchy, and that now the crown, released by the Reform Bill, might regain some of its powers, thereby solving many modern political and social problems. This idea, plus his Semitic ideals, was a tenet of the Young English party, of which he became the leader. In 1843 the landed aristocracy and country gentry found in him a spokesman for the dissatisfaction with which they regarded the threatened relaxation of the protective system. In 1846 he made a most bitter attack on Peel in the debate on the repeal of the Corn Laws, and on the death of Bentinck, in 1848, he became the acknowledged leader of the Protectionist party in the Commons. He bore generous testimony to the worth of his predecessor in his *Lord George Bentinck: A Biography* (1852). The same year the Earl of Derby offered him the post of Chancellor of the Exchequer, a position which he held with honor and credit. Seeing that the nation now desired free trade, he coolly discarded protection. His second budget was, however, rejected by the Commons, and the cabinet resigned in December, 1852. Disraeli did not resume his position until the

second Derby ministry (1858). One of his greatest disappointments was Derby's refusal to form a ministry with the aid of the Peelites in 1857, as Disraeli thought the country ready for his favorite reforms. There was but a scanty majority for the ministry of 1858, and in 1859 Disraeli's reform measure, the weak “Franchise” Bill, was rejected.

During the seven years of Liberal rule that followed Disraeli had to contend not only against the popularity of Lord Palmerston, but against suspicion and dissatisfaction in his own party. His talents, spirit, and persistency were so great during this trying time that he won admiration from all, even from his opponents. When Derby returned to power in 1866, Disraeli again became Chancellor of the Exchequer, and the most influential member of the new ministry. It was owing to him that the Conservatives now passed the famous Reform Act of 1867, which offered a far wider franchise than any previous law. In this way Disraeli hoped to outbid the Liberals, and seemingly he triumphed, succeeding Derby as Premier in 1868, only to be turned out of office one year later by a general election.

In 1874 he returned to power with a safe Conservative majority for the first time in his career. Although his ministry assured many useful reforms, like the different factory acts, the poor-law amendment, and the artisans' dwelling acts, it became famous chiefly through its foreign policy, conducted by the strong hand of Disraeli himself. His policy was aggressive and essentially imperial. He acquired control of the Suez Canal, interfered in Afghanistan to thwart Russia, and in 1877 proclaimed the Queen of England Empress of India. He called a halt to the Russian advance upon Constantinople in 1878, sending a British fleet to the Dardanelles and a division of the India army to Malta, and proudly declared on his return after making the Treaty of Berlin that he brought peace with honor. In Africa the Transvaal was annexed and the power of the Zulus broken. In 1880, however, his ministry was overthrown. His health had ere this required him to withdraw from the leadership of the House of Commons, and in 1878 he had entered the House of Lords as the Earl of Beaconsfield. On April 19, 1881, he died in London.

From whatever standpoint we view Beaconsfield's career, we cannot but be struck with wonder. That a Jewish novelist should become the acknowledged champion of the British aristocracy seems past all belief. His statesmanship was of a high order. The Empire, the constitution—these were the watchwords of his policy. His foreign policy was the continuation and development of that of Chatham, Pitt, Canning, and Palmerston, essentially aggressive and imperialist. His domestic policy was far ahead of his party's, yet he managed, unlike Peel and Gladstone, who disrupted the party, to lead it to concessions of which it had not thought—to “educate it,” as he himself said. He found the Conservatives a party of obstruction, reactionary, and out of touch with the times; he left them in line with modern development and in a position to inaugurate reforms. A Tory in theory, he was liberal in practice. What else could be said of a man who at the outset of his career advocated the establishment of the Roman church in Ireland, the enfranchisement of the British

peasantry, the reform of the provincial administration?

Disraeli's triumphs in the House of Commons were largely due to his great skill as an orator and a debater. His skill lay in a clear and dignified presentation of facts and, above all, in his marvelous use of wit and satire. This remark holds also for his literary works, the chief flavor of which lies in the witty introduction of contemporary celebrities. They often contain beautiful descriptions, but excel in the portrayal of what we call society. He writes best in the language of the salons and club-rooms. Among his best works are: *Henrietta Temple* (1837); *Coningsby* (1844), a vindication of the Jewish race; *Sybil* (1845); *Tancred* (1847), . . . in Oriental descriptions; *Lothair* (1870), a story of a weak-minded nobleman, with incidental descriptions of the life of very exalted personages in British society (1880). *Endymion* is well known and characteristic, but far inferior to *Coningsby* and *Sybil*.

Personally he was affable, constant in friendship, and prompt to discover and aid merit. In his youth he was eccentric in dress and manners, but this he outgrew; he was always theatrical and fond of attracting attention. His private life was above reproach. He married Mrs. Wyndham Lewis, a rich widow much older than himself, in 1839. He found in her "the perfect wife," and when she died in 1868 he felt "that he had no longer a home."

Consult: *Selected Speeches of the Earl of Beaconsfield*, ed. by T. E. Kebbel (London, 1881); *Lord Beaconsfield's Correspondence with his Sister*, ed. by R. Disraeli (ib., 1886); J. C. Thompson, *Public Opinion and Lord Beaconsfield* (ib., 1886); T. Martin, *Memorials of Lord Beaconsfield* (ib., 1881). Consult also the Lives by J. S. Mills (ib., 1863); T. P. O'Connor (ib., 1878), hostile; G. Brandes (Copenhagen, 1878; Eng. trans., New York, 1880), favorable; C. Clarigny (Paris, 1880); A. C. Ewald (London, 1883); F. Hitchman (ib., 1872); T. E. Kebbel (ib., 1888), excellent; Kebbel's article, "Disraeli," in *Dictionary of National Biography* (1888); J. A. Froude (ib., 1890), in S :

*Prime Ministers of Queen Victoria*; T. Martin, *The Life of H. R. H. the Prince Consort* (ib., 1880); Meynill, *Benjamin Disraeli* (ib., 1903); Sichel, *Disraeli* (ib., 1904); Monypenny, *Life of Disraeli, Earl of Beaconsfield* (ib., 1910-12). This last biography is in a sense both official and dramatic, for the author was intrusted with the Disraeli papers hitherto unpublished. The first two volumes only are completed.

**D'ISRAELI, ISAAC** (1766-1848). An English author. He was a descendant of a Hebrew family which had been in Spain and Italy. His father, Benjamin D'Israeli, went to England in 1748 and, entering into business in London, amassed a fortune. Isaac, who was born at Enfield, was educated at a school in his native town and in Amsterdam. He began his career as a poet and novelist. His *Mejnoun and Leila* (1797), of no great merit as a novel, still has the distinction of being, if not the first, at least one of the earliest Oriental romances in English. After the publication of the first volume of his *Curiosities of Literature* (1791), he discovered that his forte lay not in creative literature, but in the illustration of historical and literary character, and he devoted himself to that. His works, though

inaccurate, are interesting. By his contemporaries he was liked, both as an author and as a man. Byron wrote of him as "that most entertaining and researching writer." D'Israeli's principal works are: *Curiosities of Literature* (1791-1834); *A Dissertation on Anecdotes* (1793); *Essay on the Manners and Genius of the Literary Character* (1795); *Calamities of Authors* (2 vols., 1812-13); *Quarrels of Authors* (3 vols., 1813-14); *Inquiry into the Literary and Political Character of King James I* (1816); *Commentaries on the Life and Reign of Charles I* (1828-30); *Amenities of Literature* (1840). He was the father of Benjamin Disraeli. His *Works*, edited by his son, were published in 7 vols. (London, 1858-59). A memoir in the 1849 edition of *Curiosities of Literature*, written by his son, gives an intimate and attractive picture of him.

**DISSECTION WOUNDS** (from Lat. *dissecare*, to cut up, from *dis-*, apart + *secare*, to cut). Injuries received during the dissection of cadavers, occurring in surgeons, those who make post-mortem examinations, in butchers and cooks. Such injuries differ from ordinary infected wounds only in being more virulent. Post-mortem examinations are peculiarly dangerous when the subject has recently died of some septic disease. Dissection wounds inflicted while working on a cadaver injected with chloride of zinc are not serious, especially if they are promptly sucked until the blood runs freely, swabbed with pure carbolic acid and alcohol, or with tincture of iodine and dressed antiseptically. If infection supervenes in spite of this, the symptoms of inflammation, swelling of the lymphatic glands, with the formation of pus, accompanied by the general symptoms—chill, fever, vomiting, and prostration—follow. See PYÆMIA; SEPTICÆMIA.

**DISSEISIN**, dī-sē'zīn (OF. *disseisin*, from *disseisir*, *dissaisir*, Fr. *dessaisir*, to disseise, from *des-*, *dis-*, apart + *seisir*, *saisir*. It. *sagire*, to seize, from ML. *sacire*, to take possession of, from OHG. *sazzan*, Ger. *setzen*, to set). At common law, the process of acquiring title to land by a wrongful possession thereof, accompanied by a claim to the freehold. It involved the double notion of the ouster of the rightful owner from his seisin and the definite acquisition of seisin by the newcomer. Its extraordinary efficacy in making a wrongful act of dispossession the basis of a valid (though defeasible) title is due to the transcendent importance which at the feudal law attached to the bare fact of possession of lands. The person seised of lands—i.e., possessed of them and claiming them as his own—was not only "presumed" to be the rightful owner, as we should express it to-day, but was, to all intents and purposes, in his public as well as his private relations, regarded as the owner. As to the person whom he has ousted (the *disseisee*), the possessor may have been only a *disseisor*; but in the eye of the law he was invested with the title, which would pass by descent to his heir or which he could alienate at his pleasure.

Of course, this title was a defeasible one, which could by entry or by appropriate legal proceedings, taken within a limited time, be destroyed, notwithstanding its descent or alienation; but pending such action it was the only existing right in the land which was recognized by the law as an estate or legal interest. The disseisee, whom we call the rightful owner



was in effect only a rightful *claimant*, and what he had was not an estate or interest in the land, but a mere right of entry, which might or might not some time ripen into a legal estate, and certain cumbersome and expensive rights of action, which might or might not avail him. Though these rights were capable of transmission by descent, they could not be alienated or made available to another, and, if not exercised within the longer or shorter term to which they were limited by law, they were barred altogether. In the earliest period of English law only a few days were allowed for making a reentry upon lands—only so long as might be necessary to enable the disseisee to learn of the disseisin and make the necessary journey to the spot. Later the period of limitation was fixed by statute at 60 years and upward, and it is now, according to the jurisdiction, fixed at periods of 10 to 30 (usually 20) years, but the practice and effect of a disseisin, and the respective rights of the parties in the land, continue to be substantially the same as at common law. See ADVERSE POSSESSION; DESCENT CAST; LIMITATION; PRESCRIPTION; SEISIN. Consult the authorities referred to under REAL PROPERTY.

**DISSEMINATION** (Lat. *disseminatio*, from *disseminare*, to scatter seed, from *dis-*, away + *seminare*, to sow, from *semen*, seed). The scattering of seeds. Often used in the sense of dispersal (q.v.).

**DISSEN**, dis'sen, GEORG LUDOLPH (1784–1837). A German classical scholar, born near Göttingen. Not long after receiving his degree at the University of his native city, where he had been a pupil of the philologist Heyne, he was made professor extraordinarius (1813), and in 1817 professor in the same institution. In early life he gave especial attention to the philosophy of the ancients, but afterward devoted himself almost exclusively to æsthetic interpretation of the classics. In these he attached special importance to the development of rigid stylistic laws, which, he maintained, governed all oratorical and political compositions among the ancients. In addition to two admirable treatises, *De Temporibus et Modis Verbi Græci* (1809) and *De Philologia in Xenophontis de Socrate Commentariis Tradita* (1812), he published editions of *Pindar* (1830), *Tibullus* (1835), and the *De Corona* of Demosthenes (1837). His minor writings, *Kleine lateinische und deutsche Schriften*, with biographical reminiscences by F. Thiersch, F. G. Welcker, and K. O. Müller, appeared after his death (1839). Consult Sandys, *A History of Classical Scholarship*, vol. iii (Cambridge, 1908).

**DISSENTERS** (from Lat. *dis dissentire*, to disagree, from *dis-*, apart + *sentire*, to think). A name popularly applied to those who refuse to accept the authority or conform to the laws of an established church, specifically in England, although the word “dissidents” occurs in the acts of the Warsaw Confederation of 1573, to denote the Polish Protestants of that day. As an English term it became common in the seventeenth century to denote the bodies who separated from the Church of England; though it is not commonly applied to Roman Catholics (for whom the older title was recusants), nor to members of the Episcopal church in Scotland, though both these bodies dissent from the established churches. For the history of repressive legislation in England, and its gradual miti-

gation, see TOLERATION; NONCONFORMISTS; also ESTABLISHMENTS. ECCLESIASTICAL.

**DISSEPIMENT**. A partition in plants such as divides an ovary into compartments.

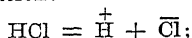
**DISSOCIATION** (Lat. *dissociatio*, from *dis-sociare*, to disrupt, from *dis-*, away + *sociare*, to associate, from *socius*, associate). A term applied in chemistry to all obviously reversible decompositions. (See DECOMPOSITION.) Two kinds of dissociation are now generally distinguished: *chemical* (in which the products of dissociation are themselves free chemical substances) and *electrolytic* (in which an ordinary chemical molecule breaks up into electrically charged particles, or *ions*).

**Chemical Dissociation**. Like ordinary chemical decomposition, chemical dissociation involves the breaking up of a given chemical substance into parts each of which is capable of independent existence. In the case of sal ammoniac (see DECOMPOSITION) the products of dissociation are ammonia gas and hydrochloric acid—two well-known chemical compounds. Other typical examples of chemical dissociation are presented by the vapor of phosphorus pentachloride, by the tetroxide of nitrogen, and by ordinary chalk. In the case of phosphorus pentachloride, which is itself colorless, the dissociation is rendered evident by the fact that of the two products—viz., phosphorus trichloride and free chlorine—the latter is green; this dissociation may therefore be readily demonstrated by heating some phosphorus pentachloride in a glass vessel. Even more striking is the dissociation of the tetroxide of nitrogen,  $N_2O_4$ , which is, at low temperatures and in a pure state, a yellowish, almost colorless liquid, but whose vapor breaks up, on the application of heat, into a dark, brownish-red oxide of nitrogen, represented by the formula  $NO_2$ . Both in the case of phosphorus pentachloride and in the case of nitrogen tetroxide, lowering the temperature causes a recombination of the products of dissociation and a consequent disappearance of the color. The manner in which the dissociation of sal ammoniac may be demonstrated is described in the article on AVOGADRO'S RULE (q.v.). It must be observed here that, according to H. B. Baker (1893), sal ammoniac does not dissociate at all if very carefully dried, nor do perfectly dry ammonia and hydrochloric acid combine to form sal ammoniac. The extent to which a compound may be dissociated is strongly influenced by two physical factors—viz., temperature and pressure. Thus, in the case of nitrogen tetroxide, the application of a moderate degree of heat would cause only a fraction of the total amount employed to break up. But, as the temperature would be allowed to rise, the dissociated fraction would increase, and this would be plainly shown by the color of the gas rapidly becoming more and more intense. On the contrary, increasing pressure would cause the dissociated fraction to diminish, as would be indicated by the gradual disappearance of the color. Careful experiments, carried out at the temperature of about 50° C., have shown that at that temperature nitrogen tetroxide is all but completely dissociated if the pressure is very greatly reduced; under a pressure of about 498 millimeters of mercury, only a half of the tetroxide is broken up. In the case of a single solid substance whose dissociation products include one or more gases, matters are somewhat different. An elevation of temperature causes,

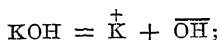


just as in the case of gases, an increase of the dissociated fraction; but at any given temperature the pressure of the gaseous product of dissociation *cannot* be increased. The phenomenon is in this respect analogous to the evaporation of water. It is well known that for every given temperature the vapor pressure of water is constant; an attempt to increase that pressure would be unsuccessful and would only cause some of the vapor to condense. This is precisely what happens in the classical case of the dissociation of chalk within a closed vessel. Under the influence of heat, chalk breaks up into quicklime and carbonic acid. The higher the temperature, the less chalk remains undissociated and the greater the amount of the carbonic acid produced. But if at a given temperature we should attempt to increase the pressure by diminishing the volume within which the substances are confined, the result would be that some of the carbonic acid would recombine with the quicklime, and thus the original pressure would soon be reestablished. This fixed pressure is often referred to as the "dissociation tension" of chalk, just as the pressure of water vapor at some given temperature is spoken of as the vapor tension of water at that temperature. Again, just as the vapor tension of water is the same whether the amount of water is large or small, so is the dissociation tension of a solid substance independent of the amount of the latter experimented upon. See PHASE RULE.

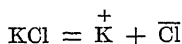
**Electrolytic Dissociation.** Quite different from the phenomenon of chemical dissociation is electrolytic dissociation; and it must be borne in mind that, while the former is a fact, the latter is theoretically inferred to be the cause of the exceptional behavior of many solutions, but cannot be gotten at directly. Nevertheless the theory of electrolytic dissociation is now almost generally accepted by chemists, and careful investigation brings forward, month after month, new proofs of the extreme probability of its correctness and usefulness. According to this theory acids, bases, and salts break up, when dissolved in water, into atoms or atomic groups, half of which are charged with positive, half with negative electricity. Thus, hydrochloric acid is supposed to dissociate according to the following equation:



caustic potash dissociates as follows:



the salt called potassium chloride, as follows:



These equations must not, however, be taken to mean that, e.g., a solution of potassium chloride contains chlorine gas and the metal potassium in the free state. Indeed, comparing a solution of potassium chloride with one of chlorine gas, it may be seen that, while some free chlorine is constantly escaping from the latter, no free chlorine can be detected in the former; a solution of potassium chloride exhibits neither the color, nor the odor, nor the bleaching power of free chlorine. The symbol  $\overline{\text{Cl}}$  denotes what is called an electronegative chlorine "ion," and the existence of an ion is not an independent existence, but involves necessarily the existence of another ion, carrying an equal charge of the

opposite form of electricity. Free chlorine gas would, however, *form* from the chlorine ions if the latter lost their electric charges; which is precisely what happens when the solution is subjected to a process of electrolysis. When the electrodes of a galvanic battery are immersed in the solution, the negative chlorine ions are attracted towards the positive electrode, by which their electric charge is neutralized. The chlorine ions then become simply chlorine atoms, and these combine in pairs, forming molecules of free chlorine gas. At the same time the positive ions are attracted and transformed into a free chemical substance, at the negative electrode; for neither can electropositive nor electronegative ions exist alone. A current of electricity is then said to pass through the solution, and the latter is said to be electrolyzed. Now, if this explanation of the mechanism of electrolysis be correct, it is evident that the electrical conductivity of a solution must be proportional to the number of free ions in it; and hence the numbers of free ions in different solutions may be ascertained by measuring the conductivities of the solutions. It is equally evident that, if the explanation is correct, the total number of *particles* (ions as well as molecules) in a solution, say, of potassium chloride is greater than what it would be if that salt were not dissociated. Comparing a solution of an electrolyte (i.e., an acid, base, or salt) with a solution of an equivalent quantity of any nonelectrolyte, the former solution must contain a larger total number of particles than the latter; because in the latter the number of particles is not increased by dissociation.

These considerations have been applied to explain the abnormal behavior of solutions of acids, bases, and salts. When dissolved in water, these substances have been known to affect its physical properties much more than equivalent amounts of substances of any other class. Thus, dissolving a given amount of common salt causes the boiling temperature of water to become much higher than dissolving an equivalent amount of sugar (a nonelectrolyte); and the same may be said of the lowering of the freezing point of water and of certain other changes in its physical properties. In the case of a nonelectrolyte, the elevation of the boiling point, as well as the depression of the freezing point, is found, for moderate amounts of substance dissolved, to be proportional to those amounts and can therefore be readily calculated. In the case of electrolytes, and only of these, that proportionality is not found to exist; and before the invention by Arrhenius of the theory of electrolytic dissociation, the exact change in physical properties of the solvent produced by these substances could not be calculated. The theory of dissociation attacks this problem in the following manner: It starts with the principle that the *relative numbers* are proportional to the number of *particles* of the dissolved substance; combines this principle with the idea that the number of free ions in a solution is shown by the electrical conductivity; calculates the total relative number of particles from the relative number of free ions present; and then calculates the elevation of the boiling point and the depression of the freezing point from the total number of particles. The figures thus obtained by theoretical calculation are found to be in remarkably close agreement with the results of actual observation, and this in-

icates the great probability of the correctness of the theory of dissociation.

Electrolytic dissociation is usually incomplete. That is to say, of the total number of molecules in solution, only some are usually dissociated into ions, the rest remaining undissociated. The dissociated fraction, representing the "degree of dissociation," depends on two factors: the concentration of the solution and the temperature. When the concentration is diminished by adding pure water to the solution, the degree of dissociation becomes greater; by adding a very large amount of water to the solution, the dissociation may in many cases be rendered complete, i.e., no molecules may be left undissociated. As to the influence of temperature, it is known that a rise of temperature causes in some cases an increase, in other cases a decrease, of the degree of dissociation. Herein is an interesting difference between electrolytic and chemical dissociation, as the latter is invariably furthered by rise of temperature.

The weakest point in the electrolytic dissociation theory is where it touches the fundamental principle of chemical dynamics, the law of mass action. (See REACTION, CHEMICAL.) According to the latter, the *square* of the concentration of the ions of a "binary" electrolyte (i.e., one whose molecule splits up into two ions, like KCl) must at all dilutions remain proportional to the concentration of the undissociated molecules. Experiment, however, shows that all "strong electrolytes" (i.e., such as are greatly dissociated) fail to obey this law! True, the deviation from the law is quite similar in all cases: the *cube* of the ion concentration is found to be (roughly) proportional to the *square* of the undissociated fraction. But this does not help matters much, and the failure of the dissociation theory to agree with a well-founded principle of chemical dynamics, in the case of all salts and all strong acids and bases, is still awaiting an adequate explanation.

Nevertheless the theory of electrolytic dissociation performs in a remarkable degree the function of a truly scientific theory, viz., that of bringing out a connection between phenomena that are seemingly very different in their nature. Who would imagine, e.g., that the boiling or freezing temperature of a solution of common salt has any connection with its electrical conductivity? Arrhenius' theory establishes an exact mathematical relation. The theory draws for us a picture of things that lie as far beyond the power of our senses as the remotest of the unseen worlds in space; yet the more proofs are adduced of the correctness of the theory, the more probable it becomes that the picture drawn by it is actually true to reality. To the practical scientist, however, this is of secondary importance. Much more important is the fact that the ionic theory furnishes indisputably valuable *working principles*. It can be and has been criticized; and scientific criticism is always useful. Nevertheless many able chemists are devoting their energy to develop it and apply it to all possible cases. Let the theory be abandoned as inadequate to-morrow; to-day it leads us to the discovery of new relations, and it has correlated (i.e., explained) a variety of facts that were unintelligible yesterday. It has already explained many of the facts of organic and analytical chemistry; it has explained the behavior of the different indicators used in alkalimetry and acidimetry;

and it is being more and more extensively applied to problems of physiology and bacteriology. Thus, the researches of Louis Kahlenberg have shown that the poisonous action of acids, bases, and salts depends on the degree of their dissociation in solutions. Similar results were obtained by Paul and Krönig, who investigated the action of acids and bases, and of the salts of mercury, gold, and silver, on the spores of the anthrax bacillus and on the vegetative forms of *Staphylococcus pyogenes aureus*. Grützner and Haffner have shown that the precipitation of casein from milk by the addition of acids depends on the degree of dissociation of the latter, and that the presence of salts modifies this relation in accordance with the theory of dissociation. The researches of Jacques Loeb have shown the importance of the applications of the electrolytic theory to the physiology of man and of the lower animals. Consult: Talbot and Blanchard, *Electrolytic Dissociation Theory* (2d ed., New York, 1907); H. C. Jones, *Freezing-Point, Boiling-Point, and Conductivity Methods* (2d ed., Easton, 1912); id., *Electrical Conductivity, Dissociation and Temperature Coefficients of Conductivity* (Washington, 1912); also the treatises on physical chemistry and electrochemistry mentioned under CHEMISTRY and ELECTROCHEMISTRY. See also SOLUTION; ACIDS.

**DISSOLVING VIEWS.** Pictures on a screen produced by a mechanical device attached to the projection lantern or stereopticon which causes the image furnished by one slide to dissolve, as it were, or blend into that of the following slide. Two lanterns are generally employed to secure this effect, which is obtained by gradually covering one of the projection lenses and allowing the rays from the other to fall on the screen.

**DIS·SONANCE** (Lat. *dissonantia*, from *dissonare*, to sound harshly). The simultaneous sounding of two or more tones foreign to a major or minor triad. Dissonance produces a feeling of unrest requiring a resolution into consonance (q.v.). This feeling of unrest is attributed to the complex ratios existing between the number of vibrations of dissonant intervals; whereas the ratios of consonant intervals are always simple. In reality it is impossible to set up any exact limits of dissonance, as what may seem dissonant to one person may seem consonant to another. But it is easy to establish certain landmarks within which each individual will, to a certain extent, determine the bounds of dissonance. Dissonant intervals are the major and minor second and all augmented or diminished intervals. (See INTERVAL.) Chords containing one or more dissonant intervals are dissonant chords and require resolution. The dissonant chords are all augmented and diminished triads, as well as all chords of the seventh and ninth. See ACOUSTICS; HARMONY; TRIAD.

**DISTAFF** (AS. *distaf*, from \* *dise*, OE. *diseen*, to dress with flax for spinning, to bedizen, LG. *diesse*, flax on the distaff + *staf*, staff). The staff on which the flax or wool is fastened, and from which the thread is drawn in spinning. As represented in ancient art, and still used by Greek peasants, it is a straight rod, from either side of which projects near one end a semicircle of cane or withes, forming a bed to which the wool or flax is attached. In both ancient and modern art the Fates are usually represented

with it, engaged in spinning the thread of life. (See PARCÆ.) It has ever been considered as the peculiar emblem of feminine as opposed to masculine occupations, and is sometimes used figuratively for a woman. See SPINNING.

**DISTAFF'S DAY, SAINT.** A name given to January 7, because it marks the return of the women to their usual daily occupation after the Christmas festivities terminating on the Twelfth Day, January 6.

**DISTANCE** (OF., Fr. *distance*, from Lat. *distantiā*, from *distare*, to be distant, from *dis-*, apart + *stare*, Gk. *istánaí*, *histanáí*, OChurch Slav. *stati*, Skt. *sthā*, to stand; connected with OHG. *stēn*, Ger. *stehen*, to stand, and ultimately with Goth. AS. *standan*, Eng. *stand*). In navigation (q.v.), the distance between any two places is the length of the rhumb line (q.v.) between the places. On the ordinary sailing chart (Mercator's projection) the rhumb line is straight. Also, the angular distance between heavenly bodies measured on the arc of the great circle passing through them.

The limit of view in a picture, or *point of distance*, as it is called in perspective, is that portion of the picture where the visual rays meet: the *middle distance* being the central portion between the extreme distance and the foreground. Distance, in a picture, is obtained by painting the tones that express the relative remoteness of a distant object with the same directness and truth that is employed in portraying those objects that are near at hand, or in the *foreground*, as it is called. When distant objects are thus true in color, the quality of distance will be produced by the diminution in size which obedience to the laws of perspective exacts. See PERSPECTIVE.

**DISTANCE, or DEPTH, PERCEPTION OF.** When we look at objects, we think that we see how far away they are. Yet their distance is not directly given with the act of vision. It is true that a few writers, e.g., Hering and James, believe that the primitive field of view is not altogether superficial, and that distance is "a genuinely optical feeling"; but the majority agree that it is derivative, built up by the association of tactual ideas with certain "signs," visual and strain sensations arising in the use of the eyes. In either case it is admitted that the "optical signs" themselves—the "criteria of distance," as they are called—are essential to the complete development of the idea. We must distinguish between the "primary," immediately given, and the "secondary," or indirect criteria. The former are (1) dissimilarity of size, (2) color, (3) position, (4) direction, (5) shape, (6) texture, (7) motion, (8) contrast, (9) focus, (10) clarity, (11) brightness, (12) sharpness, (13) definition, (14) distinctness, (15) vividness, (16) intensity, (17) force, (18) energy, (19) power, (20) strength, (21) vigor, (22) vitality, (23) animation, (24) alertness, (25) activity, (26) dynamism, (27) movement, (28) change, (29) variation, (30) diversity, (31) multiplicity, (32) complexity, (33) richness, (34) fullness, (35) completeness, (36) wholeness, (37) unity, (38) coherence, (39) consistency, (40) harmony, (41) balance, (42) proportion, (43) symmetry, (44) regularity, (45) order, (46) arrangement, (47) organization, (48) structure, (49) form, (50) shape, (51) outline, (52) contour, (53) silhouette, (54) shadow, (55) light, (56) color, (57) hue, (58) tone, (59) value, (60) chroma, (61) saturation, (62) intensity, (63) brightness, (64) luminance, (65) reflectance, (66) transmittance, (67) absorptance, (68) emissivity, (69) conductivity, (70) permeability, (71) viscosity, (72) elasticity, (73) plasticity, (74) malleability, (75) ductility, (76) tenacity, (77) strength, (78) hardness, (79) softness, (80) flexibility, (81) rigidity, (82) brittleness, (83) toughness, (84) resilience, (85) durability, (86) longevity, (87) stability, (88) permanence, (89) immutability, (90) constancy, (91) uniformity, (92) regularity, (93) predictability, (94) reliability, (95) trustworthiness, (96) honesty, (97) integrity, (98) sincerity, (99) genuineness, (100) authenticity, (101) originality, (102) novelty, (103) uniqueness, (104) individuality, (105) distinctness, (106) clarity, (107) definition, (108) sharpness, (109) focus, (110) clarity, (111) brightness, (112) intensity, (113) force, (114) energy, (115) power, (116) strength, (117) vigor, (118) vitality, (119) animation, (120) alertness, (121) activity, (122) dynamism, (123) movement, (124) change, (125) variation, (126) diversity, (127) multiplicity, (128) complexity, (129) richness, (130) fullness, (131) completeness, (132) wholeness, (133) unity, (134) coherence, (135) consistency, (136) harmony, (137) balance, (138) proportion, (139) symmetry, (140) regularity, (141) order, (142) arrangement, (143) organization, (144) structure, (145) form, (146) shape, (147) outline, (148) contour, (149) silhouette, (150) shadow, (151) light, (152) color, (153) hue, (154) tone, (155) value, (156) chroma, (157) saturation, (158) intensity, (159) brightness, (160) luminance, (161) reflectance, (162) transmittance, (163) absorptance, (164) emissivity, (165) conductivity, (166) permeability, (167) viscosity, (168) elasticity, (169) plasticity, (170) malleability, (171) ductility, (172) tenacity, (173) strength, (174) hardness, (175) softness, (176) flexibility, (177) rigidity, (178) brittleness, (179) toughness, (180) resilience, (181) durability, (182) longevity, (183) stability, (184) permanence, (185) immutability, (186) constancy, (187) uniformity, (188) regularity, (189) predictability, (190) reliability, (191) trustworthiness, (192) honesty, (193) integrity, (194) sincerity, (195) genuineness, (196) authenticity, (197) originality, (198) novelty, (199) uniqueness, (200) individuality.

dications of the distance of objects, at least up to a few hundred feet. Convergence, together with accommodation, is, according to Wundt and Airer, the essential basis of the perception of depth. But other authorities, notably Wheatstone, Hering, and Hillebrand, lay stress upon the dissimilarity of retinal images. We have given us, in our two eyes, two pictures of every object seen. The difference between the two pictures increases with the nearness of the object. The testing of the part played by this disparity in the perception of distance led to the invention of the stereoscope, which enables us artificially to reconstruct the actual retinal conditions of binocular vision.

In our daily life it is perhaps true that the secondary criteria become most important; they are at least most in evidence. These indirect data of distance are seven in number: (1) linear perspective, i.e., the perspective of drawing, the course of the contour lines of objects in the visual field; (2) aerial perspective, i.e., distinctness of outline and color tone; (3) the number of objects, or the partial covering of objects by the nearer; (4) movement of objects in the visual field, e.g., swiftly moving objects seen from the window of a moving train are known to be near; (5) movement of our own head or body, with consequent relative displacement of objects differently distant; (6) distribution of light and shade, e.g., the illusion of depth given by appropriately shaded stage settings; and (7) visual angle, i.e., the apparent size of known objects. The two last are the most influential.

While, however, the full and complete perception of depth implies the aid of vision, there can be no doubt that the blind have the perception in some degree. The sensations of pressure are bidimensional; and the movement of one part of the body over another, of the hand over external objects, of the whole body in locomotion, appears to supply the data necessary for at least a crude perception of depth. The blind have no direct means of refining this perception into an exact apprehension of distance; for that they must have recourse in the special case to such secondary criteria as the counting of steps. In all cases, refinement is rare, and the idea of the third dimension in general remains, for the majority of blind persons, both vague and intermittent. Consult: Berkeley, *An Essay Toward a New Theory of Vision* (London, 1709); Wundt, *Human and Animal Psychology*, trans. by Creighton and Titchener (ib., 1901); Titchener, *Text-Book of Psychology* (New York, 1910); James, *Principles of Psychology* (ib., 1890).

**DISTEMPER** (OF. *destemprer*, to distemper, ML. *distemperare*, from Lat. *dis-*, apart + *temperare*, to temper, from *tempus*, time). An acute disease of young carnivorous animals, especially young dogs, caused either by an ultramicroscopic virus or by an organism recently described as *Bacillus bronchisepticus*. The disease is characterized by febrile manifestations, and an acute catarrh of the mucous membranes, which is frequently followed by catarrhal pneumonia and in some cases by the development of nervous symptoms. The *peracute form* of the disease is manifested in a sudden loss of appetite, depression, groaning, *rigor mortis*, as well as high fever. After two or three days the temperature rapidly drops below

normal, whereupon death soon appears under comatous symptoms. The *acute form* also is inaugurated by high fever, the temperature rising rapidly to 40° C. or over, and remaining at this height for one or two weeks, or it falls slightly in one or two days, and then there exists only moderate fever. In severe cases the temperature rises again, owing to the development of pneumonia. The thickened slimy mucus which the inflamed membrane after some days secretes accumulates about the eyes, nostrils, and respiratory passages and, lodging in the bronchial tubes, prevents the free access of air and the proper purification of the blood. Hence ensue distressed breathing, increasing weakness, and symptoms of nervous disturbance, such as staggering gait, chorea (q.v.), and fits. It is a remarkably frequent disease of young carnivora, especially of young dogs—so much so that the great majority of the latter become affected before reaching the age of one year, the delicate, highly bred, and artificially treated varieties suffering most severely. Natural infection occurs through direct or indirect contact with affected animals. The virus is present in the catarrhal secretions of the mucous membranes and is evidently in most instances taken into the digestive canal with the food and water. Susceptibility diminishes with advancing age, so that animals over three years old are but rarely affected. Although young cats are also susceptible to the disease, it occurs in these animals much less frequently than in dogs. The symptoms and anatomical changes correspond with those of dogs affected with distemper, but the nervous symptoms are less common, and the exanthema which appears in almost one-half of all cases in dogs is usually absent.

In treating the disease the affected animals should be placed in a clean, uniformly warm place, protected from draughts, and furnished with concentrated nourishment, such as milk and strong meat broth with the yolk of an egg beaten into it. Several daily feedings with chopped salted meat cooked in steam is very beneficial. In the presence of gastrointestinal catarrh gruel may be given to it. All irritating remedies must be carefully avoided. As an abortive treatment, subcutaneous injections of trichloride of iodine are indicated. For depression and weakness, nervous stimulants are recommended, such as alcohol, in proper dilutions and in small but frequently repeated doses. When the fever becomes severe, antipyretics, such as phenacetin, should be administered. The catarrh of the respiratory organs is treated to the best advantage by the inhalations of warm vapors containing expectorants. The gastrointestinal catarrh should be treated first by regulating the diet, as described, and in the first days of the infection a cathartic, such as castor oil or calomel, as well as salol, should be given. If vomiting is present, this may be controlled by the administration of cracked ice, water containing soda, salicylate of bismuth, and in emergency with opium. Constipation, if present, should be corrected by half an ounce each of castor oil and olive oil, to which in large dogs a few grains of gray powder is a useful addition. In the presence of nervous symptoms anodynes and antispasmodics are recommended. The various serums for distemper are not very promising, as they are prepared with the aid of bacteria, which at best

are of importance only in the secondary organic lesions. Give frequently and in small quantities at a time milk and bread, or any other such simple and digestible food; and when recovery is tardy and weakness ensues, endeavor by nursing and by use of tonics and stimulants to support the strength. The same principles should be applied in treating the disease in cats.

The term "distemper" is sometimes applied to influenza (q.v.) in horses and epizootic pleuropneumonia (q.v.) in cattle. For an account of distemper in pigs, see HOG CHOLERA.

Consult Hutyra and Marek, *Pathology and Therapeutics of the Diseases of Domestic Animals*, vol. i (Chicago and London, 1912), and E. W. Hoare, *A System of Veterinary Medicine*, vol. i (ib., 1913).

**DISTEMPER (IN PAINTING).** See TEMPERA.

**DISTHENE.** See CYANITE.

**DISTICH,** *dis'tik* (Lat. *distichon*, Gk. *διστίχον*, *distichon*, *distich*, from *δι*, *di*, double + *στῖχος*, *stichos*, row, line, from *στρίχειν*, *steichein*, to tread). The classical name given to any couplet making complete sense, but especially to a hexameter and a pentameter. It was much used by the Greeks and Romans as a vehicle for the expression of single thoughts and sentiments, and hence became almost exclusively employed for the classical epigram. It was employed largely also in elegiac verse. (See ELEGY.) The great poets of modern Germany—Goethe, Schiller, etc.—have also shown a fondness for the distich and a remarkable skill in the use of it. See also CATO, DIONYSIUS.

**DISTILLATION** (Lat. *destillatio*, from *de*, down + *stillare*, to distil, from *de*, down + *stillare*, to drop, from *stilla*, drop). A process consisting in the evaporation of liquids by boiling and the subsequent liquefaction of their vapors by cooling. The purpose of distillation is to separate different substances from one another more or less completely. The process has been in use

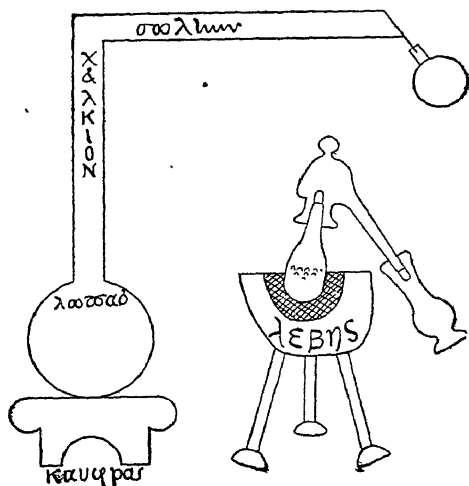


FIG. 1. DISTILLING APPARATUS AS DRAWN IN THE THIRD CENTURY A.D.

FIG. 2. DISTILLING APPARATUS AS DRAWN IN THE FIFTH CENTURY A.D.

since ancient times, and in the first centuries of our era was employed in much the same manner as at the present time. In the third century A.D. sea water was by distillation rendered fit for drinking, and it was known that practically pure water may be isolated from wine

and other aqueous mixtures by distillation. The alchemists obtained the mineral acids and other valuable substances by processes of distillation, and at the present day distillation is one of the most potent processes in the hands of the scientific and the industrial chemist.

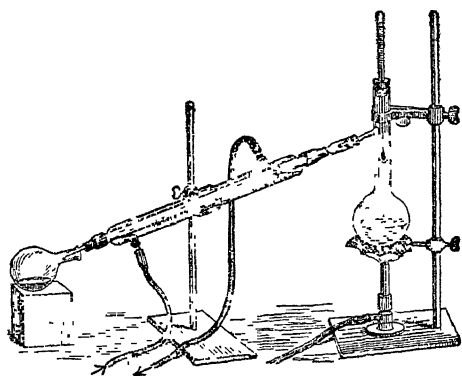


FIG. 3. MODERN DISTILLING APPARATUS.

What usually takes place during the distillation of a mixture is, in a sense, very simple: The given liquid becomes divided into portions of unequal volatility, every fraction that distills over being more volatile than the fraction that still remains behind. And as less volatile liquids boil at higher temperatures than more volatile ones, it is obvious that the boiling point of a mixture distilling under *constant pressure* must continually rise. If the mixture were allowed to evaporate at *constant temperature*, its vapor tension must continually decrease. A liquid whose vapor tension during evaporation might increase is an impossibility, for almost obvious reasons. Such a liquid and its vapor would constitute a system whose volume would increase, and not diminish, if some compressing power was brought to act upon it; which is absurd. By means of such a liquid it would be easy to obtain a form of what physicists call "perpetual motion of the second kind," which the science of thermodynamics recognizes as no less impossible than the creation of mechanical work out of nothing. (See THERMODYNAMICS.) But while the vapor tension of an evaporating mixture cannot possibly increase, it may, and in certain cases does, remain constant. Thus a mixture of 96 parts (by weight) of absolute alcohol and 4 parts of water will evaporate without change of vapor tension (the exact composition of this mixture was established by W. A. Noyes and Warfel in 1902). The question therefore remains, What mixtures are subject to decrease of vapor tension, and what mixtures evaporate without such change? The answer is: If the ingredients are present in such proportions that the vapor tension of the mixture is either the highest or the lowest that can be obtained with the given substances, then the vapor tension will remain constant during evaporation; in every other case it will decrease. If for a certain proportion of the ingredients the vapor tension of the mixture is lower than for any other proportion, the composition of the boiling liquid will approach nearer and nearer to that proportion as a limit; once that limit reached, the vapor tension cannot decrease any further, and thenceforward the composition of the distilling liquid must remain unchanged: the

vapor passing off and the liquid remaining behind will have precisely the same relative composition. Again, if at a certain temperature a given mixture has the highest vapor tension that can possibly be obtained with its ingredients, then a separation into more and less volatile portions is evidently impossible, and hence the distillation can produce no change of composition. A mixture of 96 parts of absolute alcohol and 4 parts of water has at its boiling temperature a higher vapor tension than any other mixture of water and alcohol at the same temperature; and this is why that mixture distills over without change of composition.

From the above it may be seen that the possible changes of the total vapor tension of a mixture determine in a general manner the direction in which the changes of composition will proceed in course of a distillation. To recapitulate, distillation can effect a change in the composition of a given mixture only if *both* of the following conditions are fulfilled: (1) if there exist mixtures of the same substances whose vapor tensions are *less* than that of the given mixture; (2) if there also exist mixtures of the same substances whose vapor tensions are *greater* than that of the given mixture. Distillation will then divide the given mixture into, say, two portions, one of which will be more, the other less, volatile than the given mixture. But the exact course of a distillation is far from being determined by these laws, which were, in substance, established by Kononoff in 1881. For example, no answer is thus furnished to the question: Being given a mixture of a pound of water and a pound of alcohol, and supposing that half the mixture has distilled over, what is the composition of the distillate?

In considering *quantitative* questions like this, it must be borne in mind, again, that separation of substances by distillation is only possible when the mixed vapor has a different composition from the mixed liquid by which it is emitted. From this it follows that the quantitative laws of fractional distillation must be based on a principle by which the composition of a mixed liquid and that of its vapor are correlated quantitatively. And, further, such a relationship between the composition of liquid mixtures and of their vapors can only be discovered and tested if we know how to determine the composition of mixed vapors experimentally. This last problem is not an easy one, and in many cases the older observations of different investigators disagree so grossly that the true composition of the vapors could not be considered as even approximately known. In recent years, however, Rosanoff, with several collaborators, has worked out two experimental methods which permit of ascertaining the composition of the vapors from liquid mixtures with certainty and without much difficulty. Rosanoff has, further, deduced a relationship between the vapor tensions of liquid mixtures and the composition of their vapors, and has shown how with the aid of this relationship it is possible to foretell the course of a distillation with quantitative precision. Given, then, the total vapor tensions of various mixtures of two liquids *A* and *B* (and these total vapor tensions are easily measured), it is to-day easy to answer a question like the one proposed above: viz., if from a certain weight of a given mixture of *A* and *B* a part should be removed by distillation, what would be the composition of the part removed

and what the composition of the part remaining behind? The subject is too mathematical to permit of an adequate explanation here. The student may be referred to Lord Rayleigh's paper in the *Philosophical Magazine* for 1902 and to the papers by Rosanoff and his coworkers in the *Journal of the American Chemical Society* since 1909 and the *Journal of the Franklin Institute* for 1911.

An older theory of distillation, developed by Sydney Young in collaboration with Thomas and Barrell, was based on an assumption first recommended by F. D. Brown, viz., that the ratio of the weights of the components in the vapor is, at every instant during a distillation, proportional to the ratio of the weights of the components in the liquid. But this assumption, and hence also the theory of distillation founded upon it, can now be positively stated to be erroneous except in certain very rare cases.

The theories of distillation just mentioned deal with distillation in which the vapors emitted by the boiling mixtures are immediately and completely removed as soon as formed, to be received in reliquified form in separate containers. In practice—in the laboratory and especially in industrial distillation—the vapors are partially recondensed before removal, in upright still heads, or columns, and thereby the desired separation of the ingredients is greatly hastened. The best still heads used on a laboratory scale are those of Le Bel and Henninger and of Sydney Young. The best-known stills employed industrially are those of Coffey and of Savalle. In all such apparatus the still heads are provided with a succession of traps, of one form or another, in which the vapor bubbles through small quantities of liquid produced by the partial condensation of preceding fractions of the vapor; this progressive washing of the rising vapor in the consecutive sections of the still head, combined with the cooling effect of the air . . . . . head, produces the desire . . . . .

. . . . . of the vapor and its consequent gradual enrichment in the more volatile component; so that the vapor finally escaping from the still head into the condenser is far richer in that component than the vapor first given off by the liquid boiling in the still.

The greatest practical importance must at the present time be attributed to an idea first introduced by Warren, in the sixties of the nineteenth century, later (1880) investigated by F. D. Brown, and in recent years reinvestigated, extended, and practically applied by Rosanoff. Warren conceived the idea of passing the vapors rising from a boiling liquid mixture through an upright still head whose temperature was kept constant; by actual experiments he showed that in this manner the distillation yielded a much more uniform product than would otherwise be obtained. Brown investigated the matter in the case of mixtures of two liquids and discovered the general principle involved, now known as Brown's law: that, independently of the composition of the mixture boiling in the still, the vapors escaping through a regulated still head have a constant composition, viz., the composition of the vapor given off by that particular liquid mixture which boils at the temperature at which the still head is maintained. Rosanoff, next, showed that this law works only within certain definite limits discovered by him, and that in the case of mixtures of more than two components the law assumes a still further modi-

fied form. On the basis of the Brown-Rosanoff law he has, finally, developed a distillation process depending on the employment, not of one single, regulated still head, but of a definite number of such still heads connected in series, the constant temperature of each still head to bear a certain definite relation to those of the other still heads of the series. Practical tests on all types of cases have demonstrated that the results yielded by such an apparatus are predeterminable and absolutely uniform, so that the Rosanoff process may be considered as the long-sought general solution of the problem of fractional distillation.

**Bibliography.** The best general work dealing with the older theories of distillation is Young's monograph, *Fractional Distillation* (London, 1903); consult also Kuenen, *Verdampfung und Verflüssigung von Gemischen* (Leipzig, 1906). A good description of the older forms of industrial distillation apparatus in use may be found in Stammer, *Die Branntwein-Industrie*, pp. 685-866 (Brunswick, 1895). Many valuable data on evaporation and condensation will be found in Hausbrand, *Verdampfen, Kondensieren, und Kühlen* (5th ed., Berlin, 1912). See CHEMISTRY; BOILING POINT; EVAPORATION; DISTILLED LIQUORS.

**Destructive Distillation.** This is quite different from the process described above. For while that process is purely physical and involves no chemical change whatever, destructive distillation, as implied by the term, causes profound chemical changes in the materials subjected to it. Examples of destructive distillation are: the heating of coal in gas works at a red heat, when it resolves itself into coke, which is left in the retort, and coal gas, naphtha, tar, etc., which distill over into suitable receivers; the treatment of cannel coal at and below a red heat, when it yields much paraffin wax and paraffin oil; and the distillation of wood in close vessels, at a red heat, when charcoal is left in the vessel, and wood vinegar, wood spirit, tar, etc., pass over in vapor, and are condensed. See TAR; COAL TAR; GAS, ILLUMINATING; PARAFFIN; ACETIC ACID; DIPPEL'S ANIMAL OIL; ETC.

**DISTILLED LIQUORS, or ARDENT SPIRITS.** Alcoholic liquors manufactured by the process of distillation (q.v.). They may be produced from fermented liquors or directly from the raw materials, which must contain a large percentage either of sugar or of starch. An example of the first class is brandy, which is made by distilling wine. An example of spirit produced from saccharine material is rum, which is made from molasses, while whisky, made from corn, rye, barley, or other cereal, is an example of spirit made from a starchy material. The process of distillation may be so conducted as to produce an alcoholic beverage or simply a "raw spirit." From the latter, by a process described below, is obtained the rectified spirit which is used as a basis in the manufacture of various alcoholic beverages. Rectified spirit is also employed in the arts, and from it, by a process of purification, is obtained the absolute ethyl alcohol of the chemist. See ALCOHOL.

**History.** All the intoxicating drinks used in ancient times seem to have been the product of fermentation only. The art of distilling liquors is first mentioned by an Arabian physician of the tenth century, Albukassen by name, though



the invention is attributed by some to the northern nations. The name *aqua vitæ*, given to distilled spirits, shows what an estimate was put upon the discovery by early physicians and alchemists. One of them "declares this admirable essence to be an emanation from divinity, an element newly revealed to man, but hid from antiquity because the human race were then too young to need this beverage destined to revive the energies of modern decrepitude."

**Process of Manufacture.** Spirits were first distilled from wine, but an endless variety of substances are now used in their manufacture. Alcohol, however, is the essential element in all spirits. It results from the decomposition of sugar, which, by the process of fermentation, is resolved into carbonic acid and alcohol. Sugar is therefore the direct source of alcohol, and for this reason sweet vegetables and fruits may be converted into spirits. But starch is readily converted into sugar by means of the substance called diastase, which is found in malt and in germinating seeds generally. (See BEER; BREWING.) Hence starch as well as sweet vegetables may be used in the manufacture of spirits. In making distilled liquors, when the raw material is a fermented liquor, it is ready to be distilled without further preparation; when it is a sugar, however, it must first be fermented and then distilled; when it is a starch, another initial process, to convert the starch into sugar, is necessary.

**Mashing or Preparation of the Wort.** To saccharify the starch is the object of the initial process, technically known as *mashing*. This process consists in mixing the raw grain, properly ground, with malt and with water at a temperature of about 150° F. Corn, barley, oats, and rye are the grains commonly used. In England and the United States most distillers use a mixture of raw and malted grain, in which the larger proportion is raw. The first step where raw grains are used is to cook the starch so as to render it soluble, and this is generally accomplished by steaming under pressure. This is then mixed with ground malt. This treatment requires from one to four hours, during which time the mash is kept at a uniform temperature of 145° F. by successive additions of hot water. After this saccharine infusion, technically called *wort*, has acquired its maximum density, as indicated by a saccharometer, it is drawn off. Fresh water is then poured upon the residue and allowed to stand to form a second wort. This is added to the first. A third wort, used to infuse a new mixture of grain, is sometimes made. In this method of direct mashing, nearly 10 per cent of the grain is not decomposed. The waste may be reduced to 5 per cent by heating the grain and water before the malt is added.

In Germany, where potatoes are used for the manufacture of spirits, the potatoes are steamed before the malt is applied. This is advisable because potatoes contain a much smaller proportion of starch than the cereals. By steaming, the starch cells are thoroughly broken and the starch reduced to a condition in which it is easily acted upon. Several different forms of apparatus have been devised for this purpose. In that of Henze, which is largely used, the steam is applied under pressure and the potatoes are reduced to a pulpy liquid, in which form they run into the mash tub from an opening in the bottom of the ap-

paratus. After this mass has cooled to the proper temperature, the malt is added and the wort formed as described above.

**Fermentation.** This is effected by adding either brewer's or compressed yeast to the wort prepared as described above, or to a saccharine liquid obtained from molasses, beets, or other sugar-producing fruits or vegetables. Eight to 10 parts of brewer's yeast are mixed with 1000 parts of grain mash, and with a larger proportion of yeast for potato mash. The chemical processes involved in fermentation, by which the sugar is resolved into carbon dioxide and alcohol, are discussed under YEAST and FERMENTATION. From three to nine days are consumed in fermentation. The process is continued until the density of the liquid ceases to lessen, as indicated by the saccharometer. Hydrofluoric acid has been quite generally used in the past in the fermentation process. Sadtler states, in his *Industrial Organic Chemistry* (New York, 1896), that the following advantages are claimed for its use: "(1) by preventing the losses due to secondary fermentation the alcoholic yield is increased; (2) this yield is especially maintained when raw materials of somewhat inferior quality are used, when, without the hydrofluoric acid, the yield would be diminished; (3) the development of foaming in the fermentation is largely prevented." The best practice to-day, however, is to prevent contamination of the mash and use pure yeast.

In making spirit from beets sulphuric acid is used during the fermentative process. Much of the beet spirit is made from molasses derived as a by-product from the manufacture of beet sugar. But in France it is customary to make inferior beets directly into spirit. Only a small quantity of yeast is required, and fermentation is completed in about 24 hours. In the West Indies the molasses produced in making cane sugar is utilized in the manufacture of rum. (See the article RUM for a description of its manufacture.) The addition of yeast to the saccharine liquid is not ordinarily made, but a portion of a previous fermentation is added to start the fermentation.

**Distillation.** The operations thus far described are merely preliminary. They differ from those employed in the two fermentation industries, wine and beer making, in that in preparing the liquor for distillation the fermentation process is carried to its furthest limit in order to produce the greatest possible amount of alcohol. The liquid thus prepared for distillation is technically known as the *wash*. The *still* is the apparatus in which the wash is reduced to vapor and then condensed. In its oldest and simplest form the still consists of a copper vessel, provided with a closed head, connected with a spiral tube, called the *worm*. The latter is placed in a refrigerator, or closed, chamber, through which cold water is constantly passing. When heat is applied at the still, the spirit begins to rise in vapor, along with more or less steam; these vapors pass through the worm, become condensed by the cold, and drop or trickle down into the receiver. The product of the first distillation in a simple still is a weak and impure liquid technically known as *low wines*. This is then redistilled at a lower temperature to deprive it of the water and of the fetid oils which have passed with the alcohol.

In 1801 the first great improvement in dis-



tilling was invented by a workman of Montpellier named Adam. By making the vapors rise from the still through a series of winding passages, maintained at a determinate degree of heat, and deposit part of the water and other impurities, he was able to obtain from wine a spirit of any required degree of purity at one operation. This device was applied by Pistorius to the distillation of washes made from grains. Within recent years many inventions have been made to produce the purest and strongest alcohol at the lowest possible cost. Sadtler divides the different forms of distilling apparatus into five general classes: 1. The simple stills already described, with worm condenser heated by direct firing. 2. The simple stills with closed "wash warmer." This is a device for saving fuel by causing the pipe containing the hot vapors on their way to the refrigerator coil to pass through a vessel containing the wash. Thus the wash is heated to a considerable degree before it enters the still at all. 3. Stills with rectifying wash warmer. This is a device invented by Dorn, in which the vessel through which the vapor pipe passes is divided into two compartments by a sheet of copper. The upper and larger compartment serves as a wash warmer. Through it the tube conveying the vapors from the still passes into the lower compartment, where at first the distillate is condensed. But as the wash is warmed by the vapors from the still, the distillate in this compartment gives off alcoholic vapors which pass on and are condensed in the worm, while the watery portion is allowed to run back into the still. This rectifying action can be increased by introducing two or more chambers between the still and the final condenser. 4. Stills with wash warmer, rectifying and dephlegmator apparatus for intermittent working. 5. Stills with similar apparatus for continuous working. A dephlegmator is an apparatus for partially condensing the vapor by means of metallic diaphragms. The vapor, coming in contact with these metallic sheets, is chilled, and the watery portion, which condenses most readily, separates and flows back, while the alcoholic vapors pass on through the pipes to the condenser. The Pistorius apparatus, already referred to, is an intermittent dephlegmator. The original invention has been improved successively by Gall, Schwartz, and Siemens, and is much used in Germany in making potato spirit. Examples of the fifth class of stills, those with a continuous dephlegmator apparatus, are the Coffey still, used in England for making grain spirit, and the Savalle still, used in France in distilling brandy. The Coffey still is particularly well adapted to the manufacture of what is known as "silent spirit," i.e., a spirit which is very strong and pure, but nearly destitute of flavor. For the manufacture of beverages it is not so well fitted because it removes, along with other impurities, a large proportion of the volatile oils which give them their peculiar flavor. For the principles involved in the process see DISTILLATION; EVAPORATION; BOILING POINT.

**Purifying the Distilled Spirit.** If alcohol and water were the only substances that pass over in distillation, all spirits, from whatever source, would be the same. But, except to a partial extent in the Coffey still, this is not the case. Brandy, rum, and whisky owe their distinctive flavors to essential oils derived from

the grape, from sugar, or from grain. Other impurities also pass over which are unpleasant and unwholesome. The mellowing effect of age upon spirits was formerly said to be due to the evaporation or spontaneous combustion of these oils, but is more probably due to the oxidation of the essential oils or flavoring principles. Newly distilled spirits are in general fiery and unwholesome. The process of removing the impurities from the spirit, by fractional or repeated distillation, is known as *rectifying* the spirit. The spirit that is first condensed, in rectifying, is crude and milky. Next comes the clear alcohol, which is caught separately. Last of all comes a weak spirit called *faints*, which is returned to the still. Certain impurities which give a bad flavor to the spirit cannot be removed by distillation. Several chemical methods have been proposed for their removal, but the method usually employed is to filter the alcohol, diluted with equal parts of water, through wood charcoal and then redistill. A process which has been used experimentally consists in mixing the diluted spirit with petroleum and agitating the mixture. The petroleum has the power of withdrawing the fusel oil from the mixture. Absolute or anhydrous alcohol cannot be obtained by distillation. (See ALCOHOL.) Rectified spirit of wine is the most concentrated alcohol producible by ordinary methods of distillation. The rectified spirit of the British Pharmacopeia has a specific gravity of 0.834 and contains 85.65 per cent alcohol by weight. The alcohol of the United States Pharmacopeia has a specific gravity of 0.816 and contains 92.3 per cent by weight. Proof spirit is a term applied to alcohol which conforms to the standard of the excise laws of the United States and England. English proof spirit has a specific gravity of 0.91984 and contains 49.24 per cent by weight. United States proof spirit has a specific gravity of 0.93437 and contains 42.7 per cent by weight. Alcohol is lighter than water (as 793 to 1000), and thus the lighter the liquid, the purer it is. The quantity of distilled spirits produced in the United States as stated by the Commissioner of Internal Revenue averages about 185,000,000 gallons per annum, of which about 140,000,000 gallons is consumed in the United States.

**Beverages Made from Rectified Spirit.** Whisky, brandy, and rum are distilled liquors used directly as beverages, being naturally flavored with aromatic substances derived from the materials from which they are prepared. But much of the distilled liquor produced is in the form of silent spirit, and is used to fortify wines and to arrest fermentation in them at any desired stage, and in the manufacture of factitious beverages generally. There is a large class of alcoholic beverages which are made by mixing with alcohol or brandy various aromatic substances. These distilled spirits are discussed under LIQUORS.

**Bibliography.** Brannet, *Practical Treatise on the Raw Materials and the Distillation and the Rectification of Alcohol, and the Preparation of Alcoholic Liquors, Liqueurs, Cordials, and Bitters* (Philadelphia, 1886); Gaber, *Der praktische Destillateur und Spirituosen-Fabrikant* (Vienna, 1901); Maercker, *Handbuch der Spiritusfabrikation* (Berlin, 1899), of which there is a French translation by Bosker and Warnery, entitled *Traité de la fabrication de*

*l'alcohol* (Lille, 1889); Roux, *La fabrication de l'alcohol*, in 7 parts (Paris, 1883-90); Wright, *Practical Handbook on the Distillation of Alcohol from Farm Products* (2d ed., New York, 1907); Monzert, *Practical Distiller* (ib., 1912). See LIQUORS, FERMENTED AND DISTILLED, STATISTICS AND HISTORY OF; BRANDY; WHISKY.

**DISTILLED WATER.** Water obtained by subjecting ordinary water, which contains more or less nonvolatile matter in solution, to a process of evaporation and by condensing the vapors in a separate vessel. Evidently, distilled water can contain no fixed matter, although it may and usually does hold volatile matter in solution, such as organic gases, ammonia, carbon-dioxide (and therefore also ammonium carbonate), ammonium nitrite, etc.—all these, to be sure, in very small quantities. To free distilled water from such impurities, it is acidified, say, with sulphuric acid, and a small amount of potassium permanganate is added; this acid solution is boiled, and the steam is caused to pass through another lot of distilled water, which contains an alkali (say, caustic potash) and again a certain amount of potassium permanganate, and which is kept hot; the steam is next filtered through a lot of glass wool to free it from droplets of the alkaline permanganate liquid which it may be carrying along, and finally it is condensed in a tin pipe cooler, as far as possible out of contact with the air. The first portions of the condensing vapor are rejected as not yet sufficiently pure, then a large fraction may be collected and kept pure for a time in vessels of insoluble glass (resistance glass). A sample of the purest water ever obtained was made by Kohlrusch in a vacuum established in sealed vessels of fused quartz. Absolute purity can, of course, never be attained.

Distilled waters is also the name applied in the manufacture of perfumes to the water containing the volatile aromatic principles of plants and flowers that pass over on distillation, as lavender water, rose water, etc.

**DISTINGUISHED SERVICE ORDER.** A military order instituted in 1886 by Queen Victoria for the purpose of rewarding army and navy officers. Appointments to membership are made by the sovereign, the head of the organization, for *dist. service* in the field or on sea, specially *dist. service* in dispatches to the government. Its members wear a gold cross, bearing on one side the Imperial crown and on the other the initials V. R. I.

**DISTORTION.** See LIGHT, Lenses.

**DISTRESS** (OF. *destresser*, *destrecier*, *destroisser*, from Lat. *distringere*, to pull asunder, from *dis*-, apart + *stringere*, to draw tight; connected with Lith. *stregti*, to freeze). An ancient creditor's remedy, common to all systems of primitive law, which consists in the seizure and detention by the creditor of his debtor's goods. It is one of the few survivals in our law of the practice of the personal enforcement of one's legal rights, without the intervention of the courts or the assistance of officers of justice. Originally applicable to a great variety of cases, it is now restricted to a limited number of situations, where its drastic character is mitigated by the relation of the parties to one another, and is strictly regulated by law.

Blackstone describes distress as "the taking of a personal chattel out of the possession of the wrongdoer into the possession of the party injured, to procure a satisfaction for the wrong

committed." Even in Blackstone's time, however, the scope of the remedy had been greatly narrowed, and he enumerates only two principal cases in which it was still available: (1) for nonpayment of rent or other duties annexed to the tenure of land; and (2) in the case of cattle of a stranger trespassing and doing damage (*damage feasant*) on one's land. It is still employed in these cases in England and in many of the United States. It was a remedy of feudal law, inseparable from fealty to the lord and incident to every service. It does not seem to be very popular, however, as a means of collecting rents, as it places the landlord in a better position than the other creditors. In several of the New England States distress has given place to an attachment on *mesne profits*. In New York and several other States it has been expressly abolished by statute, and in North Carolina it is held to be inconsistent with the spirit of the laws and not to exist in that State. The law of Louisiana permits the landlord to follow his tenant's goods for 15 days after removal from the premises. In general, in English and American law, the right to distrain is not limited to the goods of the debtor himself, but extends to any goods in his possession, whether belonging to him or not. But certain articles, as beasts of the plow, implements of trade, and any article at the time in personal use or occupation, have always been privileged from distress. So also where the owner, not being the debtor, is compelled by necessity to place his goods on the land, or where he does it for commercial purposes; as, in the first instance, the goods of a traveler at an inn, or, in the second, goods deposited in a warehouse on storage. Formerly the remedy of distress was limited to the seizure and detainer of the goods until the claim sought to be enforced was paid, the distrainer having no right to sell the goods, and the debtor, if he claimed the distress to be illegal, having recourse to an action of *replevin* (q.v.) for their recovery. Now, however, by statute goods taken under distress may often be sold after due advertisement at public auction and the claim of the distrainer satisfied out of the proceeds. In such a jurisdiction the character of the remedy by distress has been completely changed from a species of legal duress to a variety of attachment or execution. See LANDLORD AND TENANT; RENT.

Consult: Blackstone, *Commentaries on the Laws of England*; Maine, *Ancient Law* (Pollock's ed., London, 1909); Lectures on the *Early History of Institutions* (6th ed., ib., 1898); Gilbert, *Treatise on the Law of Distresses and Replevins* (1st ed., ib., 1757); Bullen, *Practical Treatise on the Law of Distress for Rent* (ib., 1842); and the authorities referred to under LANDLORD AND TENANT.

**DISTRIA**, dĕ'strĭ-ă, DORA. See DORA D'ISTRIA.

**DISTRIBUTION** (Lat. *distributio*, from *distribuere*, to distribute, from *dis*-, apart + *tribuere*, to give, from *tribus*, tribe). The department of political economy devoted to the consideration of the rewards which are allotted to the several factors in production. It is a familiar axiom of political economy that land, labor, capital, and enterprise are united in the production of goods, and that to each is accorded a share of the product. Distribution studies the laws which govern the recompense of the several factors, and thus includes the law of rent, the

law of wages, the law of interest, and the law of profits. It is assumed that the four factors are in possession of four different sets of persons, although this is not essential to the formulation of laws. The union in one person of two of the factors would give to him a mixed reward, the components of which would be governed by different laws. There has been a tendency in recent years to draw more sharply than formerly the line between interest and profits, to distinguish between the owner of capital, who receives interest, and the employer of capital, who receives profits. This distinction is of increasing importance in the modern world, which, with its extension of credit, permits so large a share of the world's business to be carried on by borrowed capital, and places opportunities at the disposal of energetic and enterprising men which did not exist before. The area of discussion thus outlined represents one of the most controverted fields in economic writing. It has assumed prominence especially through the attacks of the socialists, whose contention is that the distributive process is radically at fault, and thoroughly inequitable. It is interesting to observe that as the discussion of exchange gave place in Adam Smith's writings to that of production, so later, in the writings of Malthus, Ricardo, and Mill, distribution became the leading element in economic discussion. The interest shifted somewhat from questions affecting the increase of the aggregate product to the consideration of the laws governing the distribution of the product. See **POLITICAL ECONOMY; INTEREST; PROFIT; RENT.**

**DISTRIBUTION.** In its most general sense in the law, the division of a surplus fund among those legally entitled to share therein. It applies equally to the division of a trust fund among the *cestuis que trust*, of the surplus assets of a bankrupt or insolvent among the creditors, of partnership property after payment of debts among the copartners, and of the surplus in the hands of an administrator of an intestate among those entitled, as next of kin or otherwise, to share it among them.

Distribution usually refers to the last of these, and the statutes which have been enacted in Great Britain and in the United States to regulate the distribution of an intestate's personal estate are accordingly known as statutes of distribution. The matter is one wholly of statute regulation at the present time.

Formerly the personal estate of one dying intestate passed at once into the hands of the bishop of the diocese, and the disposition made of it was determined by the ecclesiastical law, administered by the so-called "ordinary court" of the diocese. There seems originally to have been no provision for the payment of the debts of the decedent, and the bulk of the estate, after deducting some small provision for the widow and children, was devoted to the purposes of the Church (*in pios usus*). It was, however, as early as 1285, provided by statute (St. Westminster II, c. 19) that the ordinary should pay the intestate's debts just as an executor was bound to do, and in 1357 it was further enacted (31 Edw. III, st. 1, c. 11) that the ordinary should commit the administration of the intestate's goods to his next and most lawful friends. The jurisdiction of the ecclesiastical courts over the administration of decedent's estates, whether testate or intestate, continued in England till 1857, when it was transferred by Act

of Parliament to the newly created Court of Probate. It is now vested in the Probate, Divorce, and Admiralty Division of the High Court of Justice, instituted by the Judicature Act of 1873. In the United States separate courts of this character, known variously as surrogates' courts, probate courts, ordinary courts, and orphans' courts, have existed from the earliest period for the exercise of this jurisdiction.

The administration of decedents' estates includes (1) the payment of funeral expenses, of the costs of administration, and of the decedent's debts; (2) in the case of an executor, the payment of the legacies given by the will; and (3) in the case of either an executor or administrator, the distribution of the surplus, if any, among those entitled thereto under the statutes of distribution.

The feudal law of land, which confined the descent of real estate to a certain person or class of persons, making as heir of the intestate, had no application to the transmission of the personal estate. That was from the beginning distributed on a more rational and humane plan, due, in large part at least, to the mild influence of the canon, or ecclesiastical, law. It has been noticed that in the earliest period the right of the widow and children to share reasonably (*partes rationabiles*) in the decedent's estate was recognized. The same principles prevail to-day. There is a much less rigid classification of those who stand in the order of distribution than is the case in the law of the descent of land, and there is nothing corresponding to the feudal preference of the male to the female, of the elder to the younger, of the whole to the half blood. In England the matter is regulated by the Statutes 22 and 23 Car. II, c. 10, and 1 Jac. II, c. 17, known as the Statutes of Distribution, and the order of distribution provided for by them follows closely that of the early law to which reference has been made. Similar statutes have been enacted in all of the United States, but these, though governed by the same principles and alike in their general outlines, vary considerably in detail. In general it may be said that if a man die, leaving a wife and children, one-third of the personal estate goes to the wife and the remaining two-thirds to the children. If there be a wife and no children, the wife takes one-half, the other half going to the next of kin of the deceased. If there be children and no wife, the children take the whole estate to the exclusion of other kindred. In England and in many of our States the position of a surviving husband is better than that of a surviving widow. The old common-law rule, that the husband is solely entitled to the personal estate upon the death of the wife, has been generally abrogated in the United States where there are also surviving children, and in many of the States his position has been completely assimilated to that of the wife. For a more detailed and exact statement of the order of distribution of intestate's estates, the reader is referred to the statutes of the several States. See the articles on **ADMINISTRATION; DESCENT; EXECUTOR**; and the authorities there referred to; and also Stimson's *American Statute Law*, vol. i (Boston, 1886).

**DISTRIBUTION OF ANIMALS**, or **Zoö-GEOGRAPHY**. Knowledge of the geographical distribution of animals, and their faunal relations past and present, constitutes a very important

part of the science of zoölogy. An animal's environment exerts a formative influence upon its character and structure. . . . of its habitat and that of its species, together with such changes as the area and range may have undergone, is therefore essential to a full understanding of the natural history of any kind of animal or animals.

#### Conditions Controlling Habitat and Range.

Some animals are fitted to dwell wholly upon land, others in water. The aquatic animals are, further, divisible into those of salt and those of fresh waters. The former have the oceans of the world open to them, yet few, if any, range through all seas; furthermore, the inhabitants of the surface of the sea differ from those of its bottom or deeper parts. Similarly, animals able to mount into the air and to fly abroad with apparent freedom are rarely cosmopolitan, and whole groups of these, as well as innumerable species and individuals, reside only within limited areas or along narrow lines of migratory travel. Fresh-water forms are likely to be restricted to separate lakes and river systems. Of the terrestrial animals none are now cosmopolitan, except those which have been carried by man to all parts of the world. (The introduced fauna of a region must always be distinguished from its indigenous fauna.) On the contrary, each of the present grand divisions of the earth has a characteristic fauna of its own, and often a whole family, order, or even subclass, belongs to one continent alone. Coincident with these restrictions and diversities, likenesses between widely separated lands are manifest; and representatives of a single group may be found in regions far distant from one another. To set forth these facts, to endeavor to account for them, and to develop their significance, is the province of *zoogeography*.

**Limits of Dispersion: The Sea as a Barrier.** Each kind of animal must have had a point of origin, whence it spread as it increased. Theoretically the expansion of a species would proceed equally in all directions, but actually this expansion has encountered barriers and restrictions that have confined and shaped habitats within certain areas, in some instances extremely wide, in others surprisingly narrow. What constitutes these barriers and restrictions? That depends in each case on the physical surroundings as related to the needs and abilities of the animal in question. It is plain that a species of fish that originated in or somehow became restricted to an inland water, e.g., Lake Baikal, could never spread beyond its shores save by accidental transplantation; while an able seagoing fish may wander indefinitely, so far as mere room is concerned. Among land animals space for expansion, then, is of prime importance. Here the firmest bounds are set by the sea. Any considerable breadth of water, and especially of salt water, is uncrossable except by rare and extraordinary accident; and even then a pregnant female or a pair must be landed on the further shore in order to start a colony, which must, furthermore, find favorable surroundings in order to survive in the new locality. This accounts for the fact that mammals and terrestrial reptiles and amphibians are absent from oceanic islands. Continuity of land, then, is necessary to the spread of a terrestrial species; and when species are found in regions now widely separated, as

shown that such regions were formerly connected by lands now submerged. Conversely, the characteristics of the present fauna of such comparable regions assist the geologist to determine when the connection was finally broken.

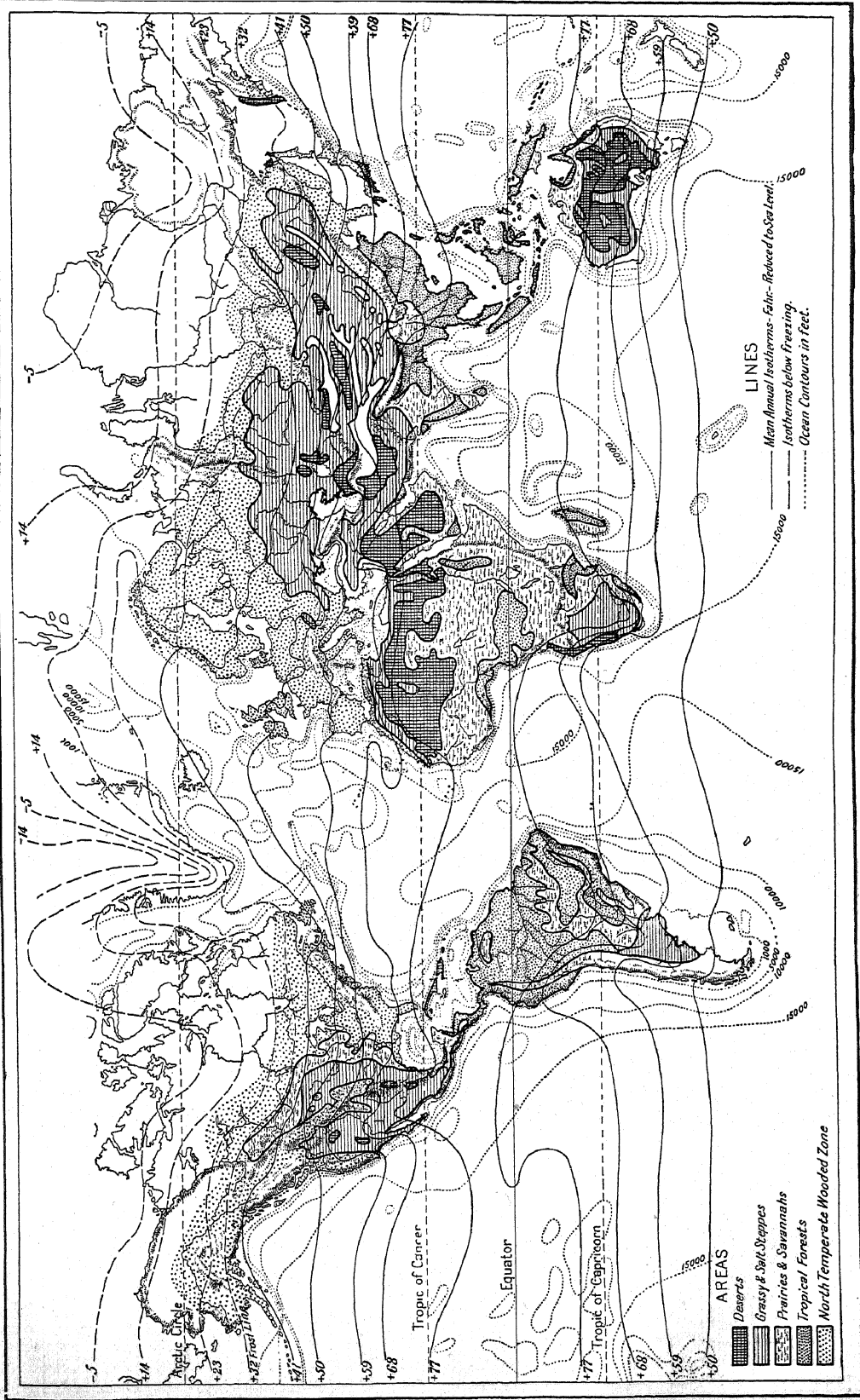
**Insular Faunas.** The faunas of most islands near continents date back to the time when these islands were a part of the adjacent mainland or were separated from it only by narrow straits. The explanation of the broad and conspicuous disparity that exists between the faunas of such large islands as Australia and Madagascar and those of Asia and Africa respectively is accounted for by the evidently very ancient date at which they became dis severed. "It is evident," remark Flower and Lydekker, "that Australia has been isolated from the Asiatic continent from some very remote geological epoch, at which period it is probable that monotremes and marsupials were the dominant, if not the sole, representatives of the mammalia then existing. Consequently Australia has never been able to receive an influx of the Eutherian orders, which have probably swept away all the marsupials except the small American opossums from the rest of the globe. Again, the large island of . . . which has a fauna of an African type, but still very markedly different from that of the mainland, may be considered to have been connected with the latter at a time when the Eutheria had become the dominant forms, but has been separated for a sufficiently long period to have enabled a large number of its species and genera to have become distinct from those of the adjacent continent. Similarly there is evidence to show that South America was probably cut off for a considerable period from the northern half of the American continent, in consequence of which its lowly organized fauna of Edentates were enabled to attain such a remarkable development in the later . . . periods. Consult Wallace, *Island Life* (New York, 1902). See ISOLATION.

"The above instances [and their converse, exemplified by the identity of insular and continental faunas where a land union is known to have existed lately] are sufficient to show . . . how largely the present distribution of mammalian life is bound up with the past history of our globe. We must, however, not omit to mention another very important agency of past times which has likewise had great influence on the present distribution of the various faunas of the Northern Hemisphere. This is the so-called Glacial epoch, which took place immediately before the establishment of the present state of things, and appears to have been the cause of the extinction of many of the larger mammalian types which formerly inhabited Europe."

But while many species have had a far wider distribution in past ages than now (and in a general way a widely distributed form may be regarded as an old form), many species seem never to have expanded much, some being limited to a short stretch of coast, or a single river valley, or to a certain mountain or island.

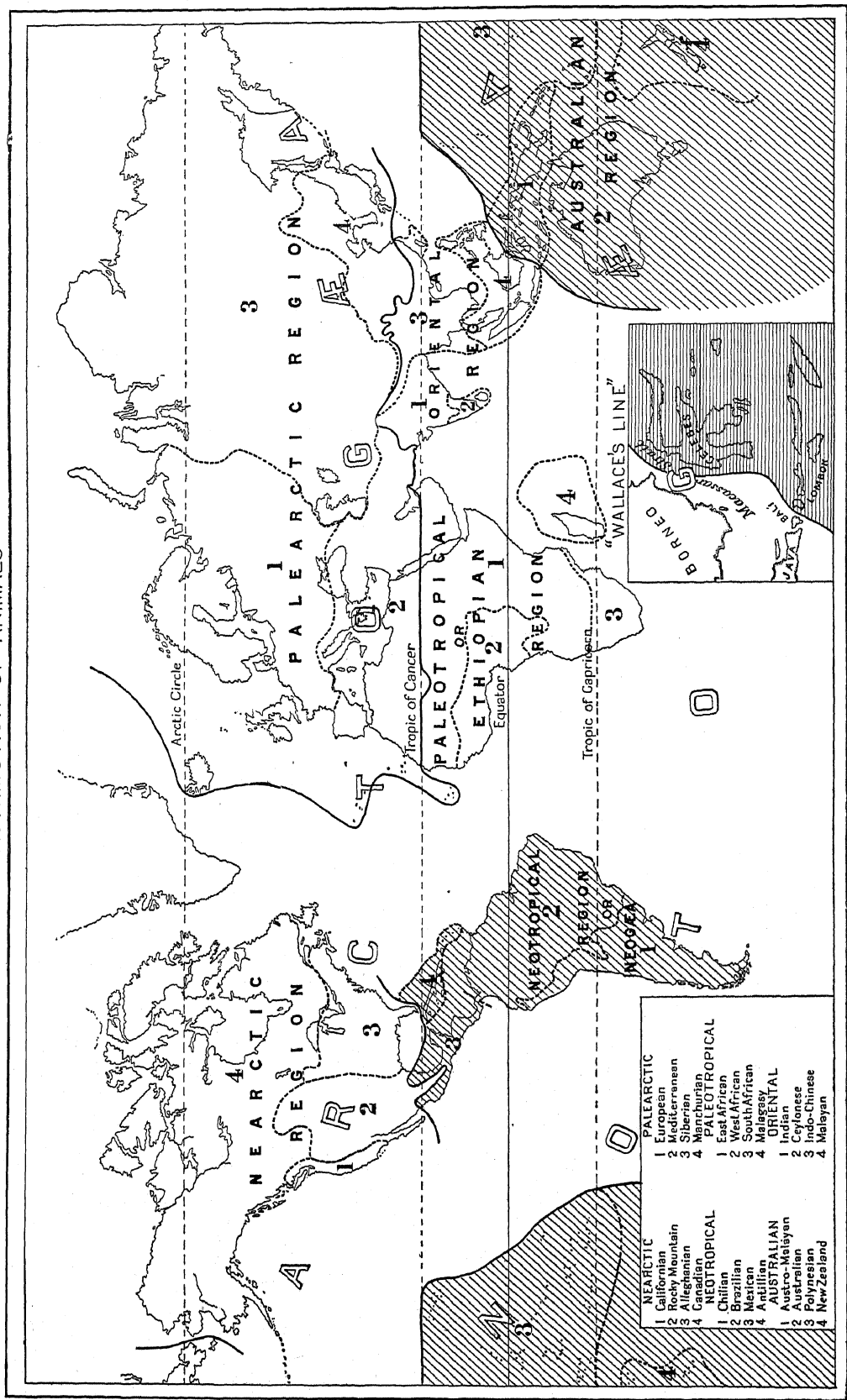
**Deserts, Mountains, etc., as Barriers.** Other barriers than the sea, therefore, have been effective in impeding the spread of crescent varieties, species, and groups. Most prominent among these is a desert region. The Sahara cuts off almost completely the fauna of Europe from that of Africa; and the continuation of

# DISTRIBUTION OF ANIMALS



PHYSICAL FEATURES OF THE EARTH AFFECTING DISTRIBUTION OF LIFE

# DISTRIBUTION OF ANIMALS



divides the northern Asiatic animals from the southern in a most emphatic way. Similarly, the fauna of North America stops and that of the southern continent begins where the plains and table-lands of Arizona and northern Mexico interpose a waterless, scantily planted space of semidesert and sterile hills, uninviting to either set of animals as a whole, yet invaded by both.

Long and lofty mountain ranges stand next in importance, probably, as physical barriers, but this is more marked in the warmer than in the cooler parts of the world, since animals accustomed to the torrid conditions of tropical plains cannot or will not endure the cold and lack of customary food encountered even on the passes, and so do not cross over the highlands. The mountains of North America seem to make less difference with the distribution of our animals, as between the Atlantic and Pacific slopes, than does the central-plains area; and that of Europe has been little affected by the presence of mountains. The Atlas Range is more marked as a boundary, but that is because of the neighboring desert; and similarly the great Central-Asian ranges are part of the lofty, cold, and arid region which as a whole forms probably the most effective inland barrier in the world.

Deep and broad rivers or straits of the sea may interrupt the spread of many species. The Hudson seems never to have been crossed by the opossum, which could neither get over nor around it. The Mississippi put an end to the eastward progress of the jaguar along the Gulf region, and much smaller rivers might stop many other creatures, such as most monkeys (which are unable to swim); yet none would prove a barrier to flying or amphibious animals, and many serve to extend hundreds of miles the range of aquatic and semiaquatic ones.

Frequently, however, neither these nor various other "barriers" that might be mentioned seem to have prevented the growth of species which nevertheless are scant in numbers and extremely restricted in area of range. The blaubok (q.v.) of South Africa was unknown beyond a single valley and has become extinct. This is a sharp example of many puzzling cases where probably the restraining influence has been competition. Each locality supplies food, water, and shelter for only a certain quota of animals. The ablest and best-fitted in each class for that region will get the most out of it and will increase and spread. The "struggle for existence" is everywhere a real daily fight for space and subsistence, and the weakest will gradually succumb or become prisoners within areas so peculiarly favorable to them that there they are able to hold their own. The powerful and gregarious cattle long ago forced the sheep to keep to the mountain pastures. Active enemies must also be considered, certain animals not being able to exist in the same territory. A river infested with crocodiles might forever prove uncrossable for small quadrupeds that otherwise might soon pass over it. The faunal distinctions between forest and prairie, mountain and plain, diurnal and nocturnal methods, are effects of enmity as well as of competition.

**Climate and Altitude as Factors.** Of climate as a determinant in geographical distribution, perhaps too much has been made in the past. Climate, within its extremes, seems influential upon animal life mainly as cold or prevailing drought affects the higher forms of vegetation (see DISTRIBUTION OF PLANTS), and

consequently the food of herbivorous and insectivorous animals. Such species as can take a varied fare, and can by migration, storage of food, or hibernation, escape or provide against storm and scarcity, defy climatic bounds. The big cats and bears range from torrid jungles to snowy mountain tops and subarctic latitudes. Transplanted species frequently flourish in climates the opposite of that to which they are native. In a general way, nevertheless, similar animals are found in similar climates, and within the larger regions lesser faunal divisions often conform closely to isothermal belts—a fact more noticeable in North America than anywhere else. Here, too, comes in the so-called "vertical" distribution of life observable in high mountains, where various altitudes exhibit an animal and plant life identical with or similar to that of northern latitudes, where a corresponding average of temperature prevails. Thus mountain ranges lying north and south carry far towards the equator along their cool ridges species which exist near sea level only in high altitudes. Our bighorn, once numerous along the Rockies south to New Mexico, is an example of this feature; and the guanaco of Patagonia, following the Andes north to the equator in Ecuador, is another. Terrestrial life is everywhere most plentiful near sea level and in warm regions and becomes more scanty as the poles are approached or mountains are ascended. Mountain tops, however, frequently form refuges for animals elsewhere known only in subarctic regions, which were left on their lofty and now isolated homes from the time when semiglacial conditions prevailed over the whole district.

**Distribution within the Sea.** Related to climatic influences on land are those conditions in the sea which set invisible bounds to the spread of most marine animals, even when apparently at full liberty to go anywhere. A few species of big whales, sharks, and predatory fishes are known in all parts of the oceanic world, and even individuals are often very far-ranging. Some others are spread throughout all the northern seas, or all the southern, as the case may be; but of tropical marine animals very few are common to both the Atlantic and the Pacific. On the contrary, the distribution of marine animals of every sort exhibits local restriction as fully as does that of land animals. Marine animals may be divided into three classes as relates to the present theme, viz., the Littoral Fauna, Pelagic Fauna, and Abyssal Fauna. To the first belongs the crowded life of the shore region, where the rocks and forests of kelp, coral reefs, and natural bottom from high-water mark down to 100 fathoms or so of depth, are the home of a vast number and variety of fixed and moving creatures of the lower orders, and a host of higher arthropods, fishes, and cestaceans which live among or upon them. These vary with the conditions. They are most abundant in the tropics and decrease towards the poles. Drifting sand and mud are nearly barren, but rocky shores are populous. Currents of cold water affect a coast unfavorably, while warm currents bring and sustain many species. Thus, physical and climatic conditions influence the amount and distribution of shore life beneath the water much as they do that above it.

The "pelagic" fauna includes those animals which habitually dwell upon or near the surface of the open ocean, visiting all parts of it. They



may be able to swim actively and so move at will here or there, and such form the class "nekton," or, like the jellyfishes and salps, may only float and be drifted about by winds and currents (the class "plankton"). Even here, however, certain species and groups are to be gathered only in certain parts of the sea; and their range seems to be limited mainly by factors of temperature. Thus, the fauna of the Gulf Stream is distinct from that of the Atlantic for a considerable distance north of Florida.

**Bathymetric Distribution.** A new element enters into the question of the distribution of life in the sea, viz., variation in depth. This is comparable, in reverse, to hypsometric distribution, or that according to height above sea level. Layers of animal life, as it were, may be observed from the shore line to the greatest explored depths. Most of the creatures to be found between tide marks are absent or rapidly decrease below a few fathoms, while many rarely approach the shore, but are numerous on bottoms covered by 100 to 300 fathoms of water. Another zone belongs mainly or exclusively below that; and the globigerina ooze (q.v.), covering the ocean bottom with grayish mud in most parts of the world, from 400 fathoms down to about 2000 fathoms, has a distinct fauna of its own. Below 2500 fathoms the sea bottom is formed of red clay, in which shells are absent, having apparently been dissolved during their descent to the greater depth. Even here, however, is found an abyssal fauna chiefly of fishes, "often of a very grotesque appearance."

This bathymetric distribution, from the 100-fathom line down, depends upon the factors of temperature and density. The former would be influenced by the ocean currents, and the animal life in the path of an influx of water from the polar regions would be different from that in the path of a warm current. The abyssal fauna is one habituated to such a degree of cold as would instantly kill much of the littoral or surface fauna. In addition to this powerful localizing influence, that of density, increasing with depth of water, is supreme as limiting the upward and downward range of animals habituated to a certain stratum, i.e., to a certain average degree of water density. Surface animals would be smothered at a mile of depth; and those brought by dredges from the abysses are often found to be burst to pieces by the expansion of the air in their cavities and tissues. Thus, vertical as well as horizontal limits are set in the sea. Too little is known of the abyssal fauna to say whether its members are world-wide or restricted to local areas; but, as the conditions in the deep ocean basins are nearly uniform and undisturbed, it is probable that all the life is widely distributed. See DEEP-SEA EXPLORATION.

**Fresh-Water Life.** The fresh-water fauna has certain characteristic features, and is divided into "fluvial" forms, inhabiting streams and rivers, and "lacustrine" forms, inhabiting large lakes, where, as in the sea, the life is divisible into "littoral," "pelagic," and "deep-water."

**Dispersion.** The slow or rapid spread of a species from its point of origination will depend upon its powers of locomotion and its adaptability to new circumstances. In the mammalia this is a matter of walking and swimming. Some are excellent swimmers, and the great spread of the tiger throughout the Orient is

mainly due to his natatorial ability. The faculty of flight has made bats more nearly cosmopolitan than is any other order of mammals. The wings of birds and insects give them a superior means of dispersal; flightless birds are, and always have been, much more circumscribed than the fliers. Reptiles and amphibians are poorly provided with means of locomotion and are often very sluggish, while fresh-water fishes, except anadromous ones, usually dwell in confined waters. As for the mollusks, lower orders of insects, worms, and small sedentary animals of the shores, their principal, and often sole, resource is in the spread of their eggs or free-swimming larvæ. Mechanical aids, however, render important assistance in the dispersal of certain species, as is the case with so many plants. Land animals, large or small, frequently float across spaces of sea on ice cakes or driftwood, and some islands have undoubtedly been colonized in this way; yet it is a remote chance to trust, for unless a pair or a pregnant female were thus transported, no gain would result. Parasitic animals are carried about by their hosts. Small crustacea and mollusks may be carried great distances by wind, or by adhering to the feet of birds. Infusoria, the eggs of rotifers, and other microscopic forms may be transported in the dried condition by the wind. Darwin brought forward much curious information on this subject in the second volume of his *Origin of Species* (London, 1882).

It will be seen that the varying abilities among the different groups of animals would make their distribution very different from one another. Salt water is a poison to larval amphibians, while birds may fly across more than 1000 miles of sea space. Mammals may run about rapidly, while the reptiles and small invertebrate creatures must creep slowly or not at all. Finally, marine animals occupy an area and medium entirely different from that held by terrestrial animals. These variations must be borne in mind in . . . reduce to scheme and system the . . . phenomena of zoögeography.

**Faunal Regions.** Heretofore we have been considering only the dispersion and restriction of a species. But, as a rule, several kindred co-exist in any given area, and these usually differ in their range, while occasionally a species of the same genus is to be found somewhere else, entirely disconnected from its fellows. This shows that the geographical area covered by a genus is greater than that of a species; and, carrying the same inquiry further, it appears true of families, orders, and classes. The larger the group in the scheme of classification, the wider its geographical area. To ascertain and record the spread, past and present, of the groups of animals is the business of zoögeography. The earlier students drew up a map in which they confidently set apart a series of realms, provinces, and subprovinces. A vast amount of such information had been tabulated by Sclater, Darwin, Schmarda, Murray, and others previously to the publication, in 1876, of Alfred Russel Wallace's monumental work on the subject. Wallace, following Sclater (1857), divided the globe into six grand "regions," each characterized by groups of animals absent from, or very scantily represented in, any other. These were:

*Palaearctic Region.*—Europe, Africa north of the Sahara, and Asia north of the Himalayas.

*Oriental Region.*—India, Malaya, southern China, Sumatra, Java, Borneo, the Philippines, and included islands.

*Australian Region.*—Australia and the islands north of it from Celebes eastward, New Zealand and the South Sea archipelagoes. This was divided from the Oriental region by Wallace's line—a name gracefully given by Huxley in 1868 to the demarcation discovered by A. N. S. Wallace, London, 1859; *Proceedings Zoological Society*, ib., 1863; *Malay Archipelago*, London and New York, 1869), which passes along the narrow straits between the Philippine and Sulu islands, and southward between Celebes and Borneo, Lombok and Java. He found the birds and mammals strikingly different on opposite sides of this line of deep channels. "The great contrast between the two divisions of the archipelago," he informs us, "is nowhere so abruptly exhibited as in passing from the island of Bali to that of Lombok, where the two regions are in closest proximity. . . . The strait is here 15 miles wide, so that we may pass in two hours from one great division of the earth to another, differing as essentially in their animal life as Europe does from America. If we travel from Java or Borneo to Celebes or the Moluccas, the difference is still more striking. In the first the forests abound in monkeys of many kinds, wild cats, deer, civets, and others, and numerous varieties of squirrels are constantly met with. In the latter none of these occur, but the prehensile-tailed cuscus is almost the only terrestrial mammal seen. . . . The birds, which are most abundant in the western islands, are woodpeckers, barbets, trogons, fruit thrushes, and leaf thrushes; they are seen daily and form the great ornithological feature of the country. In the eastern islands these are absolutely unknown, honey suckers and small lorries being the most common birds; so that the naturalist feels himself in a new world."

*Ethiopian Region.*—Africa south of the Sahara, and Madagascar.

*Nearctic Region.*—North America and the elevated central region of Mexico.

*Neotropical Region.*—South America, Central America, and the West Indies.

Each of these regions was divided into four subregions or "provinces." In Africa, Cape of Good Hope and the southeast coast formed a province, the Congo and Niger basins together another, Madagascar and the Mascarene Islands a third, and all the rest of the continent south of the Sahara a fourth. In North America, all Canada north of Lake Huron and the Saskatchewan was one province, the eastern United States as far as the central dry plains formed a second, the Rocky Mountain country and "great basin" a third, and the Pacific coast the fourth. And so on. For the faunal characteristics of each of these regions, see the articles under their names; also Holarctic Region; NEOGÆA; NOTOGÆA.

*Arctogæa and Notogæa.* The apportionment above sketched has proved too artificial. The propriety of separating North America from Europe and Asia was soon disputed, and they were united by various authorities in a single circumpolar region called Holarctic (or Periarctic). The equatorial countries, mostly separated by oceans, cannot be so easily combined, and for some time the only serious change in the classic arrangement was the erection of the

New Zealand group from secondary to primary rank. Much is to be said in favor of this movement, but it seems not to be generally acceptable.

As knowledge of both the living and fossil animals of the southern continents and islands has increased, and criteria have become largely available outside of the groups of birds and mammals upon which earlier conclusions were mainly based, it becomes more and more apparent that even these regional distinctions are vague. The best opinion at the opening of the twentieth century, following Huxley (1868), held that only two prime regions might be recognized in zoögeography—*Arctogæa*, a northern world, and *Notogæa*, a southern world. These names, however, are not precisely descriptive. *Arctogæa* includes not only the whole Northern Hemisphere, but also Paleotropica (Africa, India, and the East Indies as far as Wallace's line). *Notogæa* is formed of South and Central America and Australasia. Within these primary realms the old subdivisions seem to hold pretty well, except that North America does not seem separable from Eurasia, both now forming the single Holarctic region (q.v.) of recent students.

Lesser subdivisions must be determined independently, if at all, for each group under study. Nor have even the largest zoögeographical divisions hard and fast boundaries. They overlap and blend, forming transitional zones or debatable grounds. The stretch of mountainous deserts from the western Sahara to Manchuria is such a zone, where representatives of northern and southern faunas mingle, and where dwell many species not known elsewhere in either. The so-called "Sonoran" subregion (southwest United States to the highlands of Central America) is another borderland of debatable validity. The distinction between the Malayan and Australian subregions insisted upon by Wallace disappears entirely in respect to frogs and toads. In truth, the lesser subdivisions that have been so numerous and exactly marked off by specialists have no real existence. "They depend," to use Gadow's words (1902), "upon the class, or even order, of animals which we happen to study. The faunistic distribution of the Urodela is not that of the Anura, and both follow separate lines of dispersal, different from those of the various orders of reptiles, birds, and mammals. This must be so. There is no doubt that the distribution of land and water was totally different in the Coal age from what it is now. The face of the globe at the Jurassic age can scarcely be compared with the aspect which the world had assumed in the Miocene period. This leads to another consideration often neglected. We know that the various classes, orders, families, etc., of animals have appeared successively on the stage. A group which arose in the Coal age followed lines of dispersal different from one which was not evolved until Jurassic times, the post-Cretaceous creatures could not avail themselves of what assisted their ancestors, and vice versa. . . . Speaking generally, the older a group the more likely it is to be widely distributed. If it appears scattered, this may be due to extinction in intermediate countries, or to submergence of former land connections. . . . It is the morphologist who is ultimately responsible for the establishment of faunistic regions, not the systematist, least of all he who accepts an elab-

orate classification, and then mechanically, mathematically, by lists of genera and species, maps out the world."

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**DISTRIBUTION OF DISEASES.** It is generally known that local conditions, such as climate, variation of temperature, the composition of the soil, elevation of the land above the sea level, distribution of water, and the character of the vegetation, combine with the peculiar habits of the people to determine the greater or less prevalence of certain diseases in the different regions of the earth. The science of nosography in this aspect did not receive much attention before the beginning of the nineteenth century and is still comparatively undeveloped. The importance of climate as a factor in the distribution of diseases is obvious. Yet certain diseases, as Egyptian ophthalmia, the pellagra of Lombardy, the beri-beri of Ceylon and the Malabar coast, and the elephantiasis of the Indian peninsula, appear to have no relation to climate, but are confined to certain well-defined districts. Tropical regions are the home of malarial fevers, cholera, and hepatic diseases. This is due in part to the damp soil and decaying vegetation, particularly in the river val-

leys, affording a breeding ground for hosts of biting insects, which convey the germs of these diseases. The yellow fever of the Mexican Gulf, though often aggravated by other conditions, doubtless originated primarily from this cause. In the more temperate zones typhus, typhoid, intermittent, and scarlet fevers are found. They are, however, for the most part, not so much endemic as epidemic and owe their . . . to the crowding of people together for warmth, with its consequent ready exchange of infection. In the Northern Hemisphere, north of the tropical zone, catarrhal diseases prevail, while in the corresponding zone of the Southern Hemisphere they are much less frequent. Intestinal catarrh prevails, however, to a considerable extent in some parts of the intertropical regions. In some cases hilly regions are ravaged by fevers, while in the intervening valleys fevers seldom occur. The cultivation of the soil sometimes essentially modifies the character of the malarial diseases. The destruction of forests often results in the introduction of diseases unknown before. Indeed, as a general rule, living vegetation tends to preserve health, while decaying vegetation is a prolific source of disease. Defective drainage, natural or artificial, is also a common source of disease, especially in cities. The personal habits of races and communities in respect to diet and cleanliness exert a wide influence upon the public health. Europe, on the whole, possesses the requisite conditions of health in greater perfection than any other quarter of the world. The rates of mortality from diseases of the lungs are greater in northern than in southern latitudes. This is illustrated by the prevalence of consumption in the northeastern portion of the United States. Fevers are more prevalent in the Southern than in the Northern States. Malarial fevers are dependent on the agency of mosquitoes for their spread, and are especially fatal in the southern regions of the country; they are infrequent, however, where pine forests abound.

Consult: Annesley, *Researches into the Causes of Diseases in India* (London, 1855); Martin, *Influence of Tropical Climates on European Constitutions* (ib., 1877); Manson, *Tropical Diseases* (4th ed., New York, 1907); Twining, *Clinical Illustrations of the More Important Diseases of Bengal and Calcutta* (London, 1832-35); Morehead, *Researches on the Diseases of India* (ib., 1856). The older literature of medical geography includes the excellent works of Muhry and Boudet. Consult also: Clemon, *The Geography of Disease* (Cambridge, 1903); Davidson, *Geographical Pathology: An Inquiry into the Distribution of Infective and Climatic Diseases* (Edinburgh, 1892); Daniels, *Tropical Medicine and Hygiene* (New York, 1913). Incidental illustrations of distribution may be found under DYSENTERY; ENDEMIC; GOITRE; LEPROSY; MALARIA; PLAGUE; and in the articles on fevers.

**DISTRIBUTION OF PLANTS, PHYTOGEOGRAPHY, PLANT GEOGRAPHY, or GEOGRAPHICAL BOTANY.** That division of biological geography that deals with the distribution and with the causes of distribution of plants. The subject has been studied since the time of Linnæus, but its modern period dates from the works of Alphonse de Candolle and of Grisebach, about the middle of the nineteenth century. More recently the works of Warming, Drude, Engler, and Schimper have added much to our knowl-

edge of the subject. Phytogeography may be divided into two main heads: first, ecological phytogeography, which seeks to account for the distribution of *plant forms* (e.g., the forms peculiar to water plants, to desert plants, etc.) and the causes, mainly climatic and meteorological, of such distribution; second, floristic phytogeography, which has for its aim the subdivision of the world into floral regions and districts, and the study of the distribution of *plant species* in these regions, thus dealing with the species as units, and seeking to determine the geological and similar causes for plant distribution.

#### ECOLOGICAL PHYTOGEOGRAPHY

Schimper subdivides the world into tropical, temperate, and frigid regions, alpine districts, and the seas. Each of these divisions, especially the first two, is in turn redivided into formations. These formations, if determined by climatic factors, are termed climatic formations; if by local or soil factors, edaphic formations. For example, deserts and tropical rainy forests are climatic formations, their existence being determined mainly by the distribution of atmospheric moisture; on the other hand, the flora of a swamp or of a heath, being governed mainly by local soil factors, is spoken of as an edaphic formation.

**Climatic Formations.** In general, the climatic plant formations of the world belong to one of three types, viz., forests, grass lands, or deserts. This classification points to three great atmospheric factors—wind, moisture, temperature. Wind has acted as the great distributing agent, carrying seeds and spores from place to place. Moisture is not only necessary to the germination of seeds and the growth of plants, but its abundance or scarcity has a profound influence upon plant growth; the moist belt bordering the equator is as remarkable for the luxuriance of its vegetation as the arid districts—the great deserts of the world—under the Tropic of Cancer, are noted for their barrenness; barrenness proved, by oases at springs and by the results of irrigation, to be due mainly, if not solely, to the absence of water. The range of temperature in which plants will grow and reproduce varies widely with different species; some are capable of withstanding very low temperature, others very high, and in many instances experiment has proved that members of either group will fail under conditions favorable to members of the other. A fourth factor, light, must be considered. Light is as essential to the growth of green plants as are moisture and heat, but the amount necessary for individual species varies greatly. Some are able to thrive in even the dense shade of tropical forests; others are unable to exist except in direct sunlight. Again, the effect of the amount of light is well illustrated by the shortening of the period of growth required by cereals cultivated in the Canadian Northwest, due to the extra hours of sunshine during the growing season. Although, as yet, but little knowledge has been gained by experiment to aid in determining the exact nature of the influence of these factors on the distribution of plants, there is no room for doubt that such influences do operate. Between the equator and the poles, between the base and the top of a mountain, between the moist coastal districts

and the arid interiors of the continents, between the depths of a forest and the treeless plateau, there are gradual changes in the vegetation that mark the striking parallelism that exists between the distribution of wind, moisture, heat, and light, and the distribution of plants.

**Edaphic Formations.** As already noted, the edaphic formations are determined by local causes, mainly those which reside in the soil. Much dispute has arisen among authors as to whether chemical or physical causes are uppermost in determining distribution; dispute that obviously cannot be settled until knowledge based upon sufficient experimental data, at present sadly lacking in most instances, shall be gained upon this subject. It seems most in harmony with our present knowledge to hold with Warming that the water in the soil is the most potent factor in determining local distribution of forms. In passing from the centre of a pond to upland, plants may be encountered in more or less definite succession whose structures bear close relations to the water supply. Forms, such as duckweed, which have no root-anchorage, but drift with the wind on the surface of the water, have large air-containing chambers, which greatly increase the transpiring surface. A similar open structure is observed in water plants whose roots are anchored on the bottom and in those marsh plants growing on the margins, but as the ground becomes more and more dry, the open structure which favors transpiration gradually disappears, and devices for checking transpiration take their place. Careful study has shown clearly that there are other elements, however, which must be considered. For example, the vegetation of an undrained swamp is radically different from that of a similar moist situation on a river margin. Doubtless certain conditions of drainage enter here to cause the difference in plant forms. Again, factors which are in a certain sense atmospheric often have a local influence. Plant forms found on the north side of a hill frequently differ from those on the south side because of possible differences in exposure to moisture and wind as well as to different exposure to the sun. All of these factors may, so to speak, be regarded as edaphic, since all are similar in being local rather than climatic. In general, the edaphic formations may be subdivided into *coastal formations* or societies, and *inland formations* or societies. The coastal societies may be destructive, as illustrated by the erosion of cliffs where they break down the rocks; or they may be constructive, as illustrated by swamps and beaches, where they act in building up the land. Inland societies may be divided into those associated with river activities and those that are not. In the life of a region all areas will ultimately be worked over by rivers, so that the stages which are not associated with rivers may be regarded as more or less temporal. The ultimate condition of a region is that of the base level—the flat lowland resulting from completed erosion—towards which the other conditions are approaching, and which in a favorable climate will be covered in most instances by a mesophytic forest.

#### FLORISTIC PHYTOGEOGRAPHY

In a general presentation of the distribution of plants the algæ, fungi, liverworts, and mosses may be dismissed with a few statements. These

groups are found everywhere. It should be noted, however, that the brown algae (kelps) reach their greatest development in the colder waters, and that the lichens and mosses are more abundantly displayed in temperate and arctic than in tropical regions.

**Pteridophytes.** In number the ferns so far exceed all other pteridophytes that they may be taken as representing the group. Their greatest display is in the tropics, where they often assume the tree form and develop extraordinarily large fronds. In temperate regions they are neither abundant nor conspicuous; while in arctic and alpine conditions they are hardly at all represented. It will be noted that the distribution of ferns is almost in direct contrast to that of mosses.

**Gymnosperms.** In presenting the distribution of gymnosperms the three principal living groups must be considered separately. The cycads are strictly tropical forms, being distributed about equally between the Oriental and Occidental tropics, the genera for the most part being definitely restricted to certain regions. For example, while the genus *Cycas* ranges throughout the Oriental tropics, and *Zamia* throughout the Occidental tropics, one genus is strictly Australasian, two are African, two Mexican, and one is Cuban. The conifers form the largest group of gymnosperms, and their distribution contrasts sharply with that of the cycads, being entirely absent from the tropics and massed in the temperate regions, especially of the Northern Hemisphere. The broad tropical belt separating the conifers of the north and the south temperate regions is traversed in only two places, viz., by a southern genus, *Podocarpus*, that reaches China and Japan through the East Indies, and by a northern genus, *Libocedrus*, that reaches into temperate South America by way of the Andes. By far the greatest conifer display, with respect to number of genera and of species, is found in the districts that border the Pacific Ocean, the chief areas being the China-Japan region, the Australasian region, and western North America. The most remarkable displays of endemic genera are in the China-Japan and the Australasian regions, the former containing eight such genera and the latter five. The other regions of endemic genera are North America, with its redwood (*Sequoia*), and bald cypress (*Taxodium*), and South America, with a peculiar genus in the mountains of Patagonia. Throughout the north-temperate regions the dominant and widely distributed genera are the pine (*Pinus*), juniper (*Juniperus*), fir (*Abies*), spruce (*Picea*), cypress (*Cupressus*), and larch (*Larix*); the order of citation indicating their relative abundance. There is also a remarkable pairing of western North America and eastern Asia in the display of certain genera, no less than six genera being common to these two regions and occurring nowhere else. The distribution of the conifers of the Southern Hemisphere is modified by the temperate conditions that occur in three great isolated areas. The dominant genus, *Podocarpus*, the "pine" of the Southern Hemisphere, is the only one represented in all of these regions; but in the display of certain other genera there is a pairing of the continents, the Australasian region always being one member of the pair, and, with one exception, South America the other member. In conifers, therefore, there is much more in

common between Australia and South America than between either of them and Africa. The Gnetales, constituting the third prominent group of gymnosperms, embrace three genera of very distinct characters and distribution. *Ephedra* occurs under both tropical and temperate conditions in the arid regions of Mediterranean Europe and Africa and adjacent Asia and in arid parts of America; *Gnetum* ranges through the moist tropics of both hemispheres; while the monotypic *Welwitschia* is narrowly restricted to certain extremely arid regions of western Africa.

**Angiosperms.** The immense number of angiosperms, or true flowering plants, makes their distribution a difficult subject to present in a few statements. It must be understood, therefore, that the following presentation is very general, considering large masses of plants rather than species or even genera. It must be remembered, also, that in general the conditions of plant life are most favorable in the tropics, where there is apt to be massing; and that under arctic conditions, which are very unfavorable, vegetation is apt to be scant. The three prominent groups of angiosperms, viz., the monocotyledons and the two divisions of dicotyledons (Archichlamydeæ and Sympetalæ), must be considered separately.

**Monocotyledons.** The most conspicuous general facts in connection with the distribution of monocotyledons are as follows: *Cosmopolitan groups.*—Four great families (grass, sedge, lily, and iris), including almost 10,000 species or about one-half of the monocotyledons, are world-wide in their distribution. This means that they have succeeded in adapting themselves to every condition of soil and climate possible to flowering plants; and in this feature the grasses easily lead not only monocotyledons, but all other seed-bearing plants. Beyond the natural massing towards the tropics, the distribution of these four families is fairly uniform. *Aquatic Plants.*—The monocotyledons include an unusual number of purely aquatic families, although among the other families the number of water species is remarkable. A distinct water habit is associated with world-wide distribution, not merely of families, but often of species. For example, the common cat-tail rush (*Typha*) of the United States is also found in Europe, Asia, and Africa. But it must be noted that although these aquatic families of monocotyledons are world-wide in their distribution, their number of species is remarkably small, being about 180. In contrasting this with the 10,000 species of the four terrestrial families above referred to, it becomes evident that the relatively uniform conditions of aquatic life do not result in the evolution of species as do the extremely varied conditions of terrestrial life. *Tropical Plants.*—The remarkable massing of monocotyledonous families in the tropics, far in excess of any normal ratio of tropical increase, makes it evident that the monocotyledons as a whole must be considered the leading tropical group of angiosperms. This tropical massing is indicated by the fact that, excluding the 10 families of world-wide distribution, 23 out of the 33 remaining families are tropical. It is even more strongly indicated by the fact that, excluding the 10,000 species that were noted above as belonging to the four world-wide families, all but a few hundred of the remaining 10,000 are tropical. The approxi-

mately equal distribution of tropical forms between the two hemispheres is noteworthy. This is true not merely in the number of families, but in genera and species as well. There are four or five families peculiar to the Orient, seven or eight peculiar to the Occident, and perhaps 10 or 11 common to both. The palms may be taken as an illustration of the distribution of tropical monocotyledons. There are approximately 1000 species of palms, almost exactly divided between the two hemispheres, but not a single native species is common to the two. The genera are about 130, approximately, 75 of them being Oriental and 55 Occidental, the apparent inequality being accounted for by the more numerous monotypic genera in the Orient, due to the larger and more broken tropical area, but the two hemispheres have not a genus in common. The family is divided into great tribes, but not one of these tribes is common to the two hemispheres. These tribes are groups of genera on the way to becoming families and by some are regarded as such already. The palms thus notably illustrate the effect of long separation in plant adaptation to continental diversities, temperate and arctic conditions long having cut off the connecting land between the tropical regions of the two hemispheres, which are believed to have been united in prehistoric times and between which plant and animal forms could migrate. The preponderance of epiphytic forms in the Occidental tropics is probably associated with the great development there of the rainy tropical forest. The two great epiphytic groups of flowering plants are bromelias and orchids, both monocotyledons, the former family being restricted to the Occidental tropics, and the latter much more abundant there than in the Orient. The general adaptation of the monocotyledons to tropical conditions is emphasized by the extreme dearth of monocotyledonous species in arctic and alpine regions, only the few species belonging to the four families of universal distribution being present. The feeble representation of monocotyledons in the S. S. outside of the tropics is . . . only four small families belonging exclusively to this region; and in Australia, a continent prolific of endemic forms among gymnosperms and dicotyledons, there is but a single endemic family of monocotyledons, containing only four species. A family of most peculiar distribution is the Stemonaceæ, comprising only seven or eight species, but serving to illustrate how a family once widely distributed may later occur only in widely separated areas. One genus, *Stemona*, occurs from the Himalayas to southern Australia; another, *Crotonia*, in Florida, Georgia, and Japan; and the third, *Stichneuron*, in the East Indies.

**Dicotyledons.** There are approximately 80,000 species of dicotyledons, about equally divided between the two great groups Archichlamydeæ and Sympetalæ. These must be considered separately, since they have developed independently and are quite distinct in the general features of the geographical distribution.

**Archichlamydeæ.** The most conspicuous facts in connection with the distribution of the Archichlamydeæ are as follows: In the representation of tropical families there is a notable pairing of continents, the American tropics usually being one member of the pair, and Asia or Africa the other. For example, the great

alliance to which buttercups, mustards, poppies, laurels, etc., belong is represented by tropical forms chiefly in America and Asia, the omission of Africa being notable; the alliance to which geraniums, balsams, flaxes, rue, etc., belong has its tropical forms chiefly in America and Africa; while the melastomas are massed in Brazil, and the myrtles are common to South America and Australia. Thus the predominance of America appears in the display of tropical Archichlamydeæ. This becomes all the more clear from the statement that in America almost all the tropical and subtropical families are represented, and two very large families, the cactus and melastoma families, are found as natives exclusively in America. The Archichlamydeæ are also peculiar in not containing any terrestrial family of worldwide distribution, as do the monocotyledons and Sympetalæ; nor is there any distinctly boreal family as among the Sympetalæ. There have been developed among them certain very characteristic north-temperate families, the smartweeds, pinks, crowfoots, mustards, saxifrages, roses, evening primroses, and umbellifers, all of which, however have their representatives in tropical and boreal regions; but the display of these forms is not to be compared with the massing of the Sympetalæ in the temperate regions. While there is a much larger display of Archichlamydeæ in the north-temperate than in the south-temperate regions, two very large and characteristic families have been developed in the Southern Hemisphere, viz., the Proteaceæ, trees that belong to the same general alliance as do the oaks, elms, hickories, etc., of the Northern Hemisphere; and the Thymelæaceæ, characteristic of Australia and the Cape region of Africa, and represented in our American flora by the leatherwood (*Dirca*). The Archichlamydeæ contain most of the hardwood trees, and it is interesting to note that the trees of the tropics and the temperate zones belong to different alliances. For example, the oaks, hickories, elms, beeches, birches, etc., belong to a great alliance characteristic of north-temperate regions, while the laurel, belonging to an entirely different alliance, is the characteristic forest type of the tropics. By far the greatest family of the Archichlamydeæ, in point of numbers and general success, is the pea family (Leguminosæ), represented by about 7000 species. Although it seems to be abundantly displayed in the temperate regions, it is far more extensively represented in the tropics, being the greatest tropical family of the group. The lianas or climbers are chiefly represented among Archichlamydeæ by such forms as the grapevines and their allies. Naturally, they are chiefly displayed in tropical forests and are most largely developed in the moist forests of South America, as are the epiphytic orchids and bromelias among the monocotyledons. Their next largest display is in Africa.

**Sympetalæ.** The Sympetalæ are the ranking plants of the plant kingdom and are also those most recently evolved. While they include a number of shrubs and trees in the tropics, they are by no means so extensively represented in temperate regions by shrubs and trees as are the Archichlamydeæ. The prominent facts of their distribution are as follows: The earlier groups of angiosperms (Archichlamydeæ and monocotyledons) were massed in the tropics, the temperate and boreal regions being rela-



tively poor in true flowering plants. The Sympetalæ, therefore, while largely represented in the tropics, found the temperate and boreal regions comparatively free for occupation, and it is in these regions that they have become peculiarly dominant. This does not mean that there are not more Sympetalæ in the tropics than in the temperate regions, for the proportion of species in favor of the former is about three to two; but it does mean that this is about the normal ratio of tropical increase, which is far exceeded by the other groups. Accordingly, of the Sympetalæ alone can it be said that their distribution throughout tropical and temperate regions is about uniform. The families of Sympetalæ are not only better defined structurally than those of the Archichlamydeæ, but their geographical distribution is much more definite. This follows the fact that they are more highly specialized and more definitely related to environment than are the Archichlamydeæ. Among the Sympetalæ, three families—the plantains, mints, and composites—have a world-wide distribution. The Compositæ, as the ranking family of the plant kingdom, and also the youngest and largest, deserves special mention. It includes at least 12,000 species, which, although found everywhere, are most numerous in the temperate regions, where they constitute from one-tenth to one-seventh of all of the seed-bearing plants of every flora. They are especially characteristic of temperate America, where asters, goldenrods, sunflowers, etc., abound. Two great north-temperate families, the figworts and the borages, have also been developed; and the heaths form a family characteristic of boreal conditions.

The impress a peculiar region may have upon the general aspect of its vegetation, resulting in the assumption of the same general appearance by plants of the most diverse relationships, is illustrated by the fact that many sympetalous families of South America are characterized by a heathlike habit, the region being known as one of the heathlike plants. There is no such notable continental pairing as is shown by the Archichlamydeæ and the monocotyledons, due probably to the fact that extensive forests and boreal distribution permit free intermingling of continental flora. Among tropical Sympetalæ, however, the pairing is somewhat evident, and in tropical display America is distinctly dominant. It is also worthy of note that there is a remarkable paucity of aquatic plants among Sympetalæ compared with Archichlamydeæ and monocotyledons. This seems to be related to the fact that the latter groups had already become well established in fresh and brackish waters, while it was the temperate and boreal land surface that was especially free for occupation by the Sympetalæ.

**Conclusion.** Through the lapse of time since the advent of plant life upon the earth, the meteorological factors—wind, moisture, heat, and light—have been at work as plant distributors. At divers times and in many parts of the world their work has been interrupted, assisted, or rendered nugatory by geological agents—glaciers, especially of the ice age, which have driven vegetation before them and exiled many plants from their pristine homes; seismic upheavals or sinkings, the former interposing tall mountain ranges, the latter wide oceans, beyond which certain species could not migrate,

and which to a greater or less degree isolated these species, sometimes genera, families, and even tribes. The efforts of these factors and agents have been and are assisted by man, by other animals, and by plants; the first either wittingly carrying useful or ornamental species from country to country, or more often unwittingly introducing useless or even noxious ones; the second in a more limited range transporting seed either in or on their bodies; the third breaking down and disintegrating rock, becoming incorporated with the detritus and thus affording a habitation to a succeeding plant society. Far from having ceased their labors, these meteorological factors and geological agents, working in conjunction or in conflict, still profoundly influence the ceaseless change in the distribution of plants.

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**DISTRIBUTIVE LAW.** In its elementary form this mathematical law may be expressed thus: To multiply any compound expression by a simple expression is to multiply each term of the compound expression by the multiplier and to write the separate products in order, affecting each product with its proper sign. Symbolically:

$= a(= b = c = d \dots) = = ab = ac = ad = \dots$   
 $a, b, c, \dots$  being any algebraic quantities.  
 See CALCULUS.

**DISTRIBUTOR** (in motor vehicle). See MOTOR VEHICLE.

**DISTRICT** (ML. *districtus*, territory wherein a lord may distrain, from Lat. *distringere*, to pull asunder). A political subdivision of a city, county, or state, which forms the basis of legislative representation. Its boundaries are fixed by law, either by the enactment of the legislature or by the adjudication of a court to whom this power is delegated. The citizens thereof assemble within these boundaries and vote for local, state, and national officials. In the United States the boundaries of the congressional district in each State are determined by the State Legislature after the apportion-



ment of representation has been made by Congress, following on every decennial census. The ratio of representation under the census of 1910 was 212,407, and the total number of congressional districts 435. There is no definite principle laid down for the manner in which a State may be redistricted, and, as a rule, the party in power will, as far as possible, so distribute representation as to insure its continued supremacy. See GERRYMANDER.

For the purposes of taxation the term has a broader meaning, and the Supreme Court of the United States has decided that for the collection of taxes a district means any part of a State described for the purpose of assessment, without reference to the civil or political divisions of the State made for election purposes. See *Kelly v. Sanders*, 99 *United States Reports*, p. 441.

**DISTRICT ATTORNEY.** In the United States, the public prosecuting officer within a defined district. The office is one of great importance in the administration of the criminal law, including, as it does, the investigation of charges of crime, the gathering of evidence against alleged criminals, the submission of criminal charges to the grand jury of the county or district, and the drawing of indictments, as well as the supervision of the several stages of the criminal prosecution and the actual trial of the accused. The power necessarily inherent in the office of the district attorney to determine whether the evidence in a given case warrants the finding of an indictment and under certain circumstances to dismiss an indictment or to enter a *nolle prosequi* (q.v.), gives him a position of commanding influence in criminal prosecutions. In some States and in the Federal courts the district attorney can dismiss or nol-pros an indictment only with the consent of the court. As the jurisdiction over crimes is, under the Federal system of the United States, divided between the Federal and the State courts, the Federal government has one set of district attorneys, and each State has an entirely different set for the same territory. The former are appointed by the President and are in reality deputies of the Attorney-General of the United States, to whom they are required to make report of their official acts, and to whose direction and control they are subject. They are appointed for the several districts into which the United States are divided for district courts, and are charged with prosecuting offenses against the Federal government as well as with conducting civil actions on behalf of the government and in some cases on behalf of government officers.

In most of the States a State district attorney is elected in each county, although his most important duties, as a rule, are discharged in prosecuting criminals before the State courts. He is also the prosecuting officer before the county court of the county in which he is elected. He is in some States subject to the control of the Attorney-General and in New York is removable by the Governor. In certain contingencies he may call upon the Attorney-General of the State for assistance in important criminal prosecutions. His duties and powers are regulated by the statutes in accordance with which he is appointed or elected. Under the common-law system the prosecution of criminal offenses was left to the initiative of the persons injured or

other private persons representing them, and in England it was not until 1879 that the state undertook that duty in any effective or systematic way. By Act of Parliament in that year (42 and 43 Vict., c. 22) and in 1882 (47 and 48 Vict., c. 58) a new department was created under a "Director of Public Prosecutions," whose functions and powers are substantially like those of the district attorney in the United States. See CRIME; CRIMINAL PROCEDURE.

**DISTRICT COURT.** A court having a jurisdiction limited to a defined judicial district. Several of the United States have divided their territory into judicial districts, but the court of the district is usually a branch or "term" of the highest court of original jurisdiction of the State and not a separate tribunal.

The District Courts of the United States, however, are district tribunals subordinate to the circuit courts of appeal. With the exception of cases affecting diplomatic representatives of foreign powers and those in which a State is a party, as to which the Supreme Court has original jurisdiction, the district courts have original jurisdiction in all cases to which the judicial power of the United States extends. Prior to 1911 the circuit courts shared original jurisdiction with the district courts, but by the Judiciary Code, enacted by Congress in that year, the circuit courts became purely appellate tribunals, their original jurisdiction being transferred to the district courts. Criminal bankruptcy and admiralty causes are important branches of their jurisdiction. Each of the nine judicial circuits (corresponding to the number of justices of the Supreme Court) is divided into a larger or smaller number of districts. In some instances a district embraces the whole territory of a State; in others, States are divided into two or more districts. In three instances a single judge serves two districts. In the southern district of New York and in the district of Alaska there are four judges; and 13 districts, one of which is the district of Texas, have two judges each. With these exceptions there is one judge for each district, making a total of 84 district judges in all. See COURT, *United States Courts*.

**DISTRICT OF COLUMBIA.** A territory embracing 60 square miles of land surface and 10 square miles of water surface situated on the east bank of the Potomac River, between Maryland and Virginia (Map: Maryland, K 5 and B 7). The surface is flat and marshy along the Potomac, but elsewhere gently rolling and hilly. The Anacostia River, or Eastern Branch (of the Potomac), crosses the southern portion, and Rock Creek, a stream of considerable picturesque scenery, traverses the northern part. The climate (mean temperature, 55° F.) is subject to sudden and extreme variations of temperature. The rainfall is about 50 inches annually. Snow falls in the winter, but is generally of short duration. The soil is a light sandy loam. In 1910 about 6000 acres, 13 per cent of the area, was contained in farms. The nature of the agricultural industries is determined by the proximity to Washington, and the products are chiefly those of the vegetable garden and the dairy. The largest acreage therefore consists of hay and pasture lands and gardens. Floriculture is of considerable importance, the annual returns from this source exceeding half a million dollars.

**Manufactures.** Although the city of Wash-

ington, which is coextensive with the District of Columbia, is not essentially a manufacturing city, the number and importance of its industries are steadily increasing. Manufacturing operations carried on in the District by the Federal government are of considerable importance, but, as they are conducted under conditions which in many respects differ from those prevailing in establishments operated under private ownership, statistics for them are not included with those of the older industries. The table below shows the principal industries in 1909 and the most important facts in relation to them.

miles; in 1850 the population was 51,687; in 1860, 75,080; in 1870, 131,700; in 1890, 230,392; in 1900, 278,700; in 1910, 331,069; in 1913 (police census), 353,297. There was in 1913 a very small foreign-born population, but the negro element was large—98,144. The mass of the population is centred in the city of Washington. The villages surrounding it bear the relation of suburbs to the city proper.

**Government.** The District of Columbia was established as the seat of government of the United States under authority of Acts of Congress approved by President Washington July

INDUSTRY	Number of establishments	WAGE EARNERS		VALUE OF PRODUCTS		VALUE ADDED BY MANUFACTURE		PER CENT OF INCREASE	
		Average number	Per cent distribution	Amount	Per cent distribution	Amount	Per cent distribution	Value of products 1904-09	Value added by manufacture 1904-09
All industries.....	518	7,707	100.0	25,289,000	100.0	15,043,000	100.0	37.7	41.6
Printing and publishing.....	156	1,565	20.3	4,899,000	19.4	3,805,000	25.3	23.8	13.3
Bread and other bakery products...	71	975	12.7	3,590,000	14.2	1,388,000	9.2	34.2	26.8
Liquors, malt.....	5	248	3.2	1,805,000	7.1	1,380,000	9.2	54.7	65.9
Lumber and machine-shop products	23	509	6.6	1,175,000	4.6	709,000	4.7	165.2	154.1
Foundry and timber products.....	10	309	4.0	609,000	2.4	355,000	2.4	55.4	43.1
Marble and stone work.....	15	265	3.4	549,000	2.2	299,000	2.0	.....	.....
Flour-mill and gristmill products.....	7	38	0.5	506,000	2.0	74,000	0.5	-23.3	-19.6
All other industries.....	231	3,798	49.3	12,156,000	48.1	7,033,000	46.8	.....	.....

A minus sign (—) denotes decrease. Where the percentages are omitted comparable figures can not be given.

It will be noted from this table that, exclusive of the establishments operated by the Government, there were in 1909 in the District 518 manufacturing concerns, which gave employment to an average of 9758 persons and paid out \$6,835,000 in salaries and wages. In general, the industries of the District show a much greater increase from the period 1904-09 than for the period 1899-1904. The average number of wage earners employed in 1909 was 7707, of whom 6861 were males and 827 females (of 16 years of age or over). Those in employment under 16 years of age numbered 19, compared with 74 in 1904. A large proportion of the wage earners of the District are employed by the Federal government in operations similar to those carried on in manufacturing establishments under private ownership. These operations, however, are carried on for the exclusive benefit of the government, and, as the products are not manufactured for sale and therefore have no commercial value, no value of products can be shown. Of these industries the most important are those connected with engraving and printing, including the Bureau of Engraving and Printing, and establishments operated in the Geodetic Survey, the Geological Survey, and the Department of State; those connected with the manufacture of professional and scientific instruments, chiefly for the Smithsonian Institution, and those connected with the government printing, which includes the Government Printing Office and establishments operated in the Weather Bureau and the War Department. The total number of persons engaged in these and other industries in 1909 was 11,666. The wage earners numbered 10,657. The capital invested was \$28,479,599.

**Population.** The population in 1800, when the area was nearly one-third larger than at present, numbered 14,093; in 1846 the area was reduced from 100 square miles to 69¼ square

16, 1790, and March 3, 1791. It originally consisted of 69¼ square miles ceded by Maryland and 30¼ square miles ceded by Virginia. When the District was first created, the only municipal corporation it contained was the town of Georgetown, which was governed by a mayor and city council. The remainder of the District was under the jurisdiction of a body of justices of the peace, styled "Justices of the Levy Court." The portion of this remainder which was laid out as the city of Washington by the commissioners appointed by the President of the United States under the Act of July 16, 1790, and the amendment thereto, was governed by these commissioners and the President of the United States, from Jan. 22, 1791, until the incorporation of the city council. This form of control continued until June 1, 1871, when these three governments were abolished and the whole District of Columbia was placed under a territorial form of government, entitled "The District of Columbia," which consisted of a governor; a board of public works; a secretary; a board of health; a council of 11 members, all appointed by the President of the United States; a house of delegates, consisting of 22 members, and a delegate in the House of Representatives of the United States, both elected by the people of the District. This form of government was abolished by Congress on June 20, 1874, and a temporary government, consisting of three commissioners appointed by the President of the United States, was appointed in its place. This continued until July 1, 1878, when, by an Act of Congress approved June 11, 1878, it was succeeded by the present permanent form of municipal government, entitled "The District of Columbia," the principal executive power of which is vested in a board of three commissioners, appointed by the President of the United States.

On Sept. 7, 1846, the portion of the District derived from Virginia was ceded to that State upon the petition of the inhabitants thereof, by a vote of 763 to 222.

The people of the District of Columbia have no vote in municipal or national affairs.

**History.** Within the present District, probably on the site of Anacostia, stood the famous Indian village of Powhattan, Nacochtank, or Anacostan, which Captain Smith visited in 1608. In 1663 Francis Pope, an Englishman, established a plantation where Washington was afterward built. To the site of Georgetown settlers came probably as early as 1665, and in 1751 a town was laid out here, which in 1789 was regularly incorporated. Immediately after the close of the Revolution there was much discussion about the location of the permanent seat of government, and, after the adoption of the Constitution in 1789, this question gave rise to the first debate which aroused bitter sectional feeling. Finally, by an Act approved July 16, 1790, and amended March 3, 1791, after the claims of New York, Philadelphia, Germantown, Baltimore, Wilmington, Del., and several other places had been fully considered, Congress decided that after 1800 the Federal capital should be moved to "a district or territory not exceeding 10 miles square on the River Potomac between the mouth of the Eastern Branch and the Conogochague." This decision was reached partly as the result of a compromise and partly in deference to the known wishes of Washington.

**DISTRINGAS**, *dis-trin'gäs*. A writ or process in the nature of an attachment or execution, taken from the emphatic word of the writ directed to the sheriff, viz., "It is hereby commanded *that you distrain*" the defendant, etc. It was formerly issued in England for a variety of purposes, such as forcing a defendant who neglected to appear to present himself in court, or forcing a corporation to obey a subpoena, or compelling jurors to attend court, or a defendant in an action in detinue after judgment to deliver the goods to the plaintiff. The writ has been abolished in England, as well as in most of the United States, although in Virginia it is retained as a form of execution in cases of detinue. See **EXECUTION**.

**DISTURBANCE.** The common-law offense of violating an incorporeal property right, as an easement, a profit, or a public right, as a highway, in the land of another. As such rights do not carry with them the right of possession, they cannot usually be protected by the action of trespass, which contemplates an interference with the possession of a corporeal interest in land. But such rights, however impalpable, do really constitute property, and they will be protected by appropriate legal proceedings against a disturbance by the owner of the land or by any other person whatsoever. In a few cases, as where one has an exclusive right to the use of another's land, as a sole and several pasturage—such right being nearly equivalent to the right of possession of the premises—the action of trespass is available for its protection. In other cases the disturbance constitutes a nuisance, which may be abated either by its abatement by the act of the party injured, thereby, or by the action known as "trespass on the case," or, more shortly, "case"; or, in a proper case, by an injunction in equity.

The forms of disturbance are various, depending upon the nature of the right involved. Thus,

a common of pasture may be disturbed by shutting or driving out the cattle of the claimant of the right, or by unlawfully permitting other cattle to crop the herbage. In the last case the claimant may take the cattle damage feasant and impound them. A franchise is disturbed by wrongfully taking the tolls accruing therefrom or by setting up a competing use, as a bridge, ferry, or turnpike. Disturbance of ways happens "where a person who hath a right of way over another's ground by grant or prescription is obstructed by inclosures or other obstacles, or by plowing across it, by which means he cannot enjoy his right of way, or at least in so commodious a manner as he might have done" (2 Bl. Com. 242). This is remediable by the act of the party injured, removing the obstacle, or by an action on the case.

All of these forms of disturbance of private rights, together with the remedies appropriate to them, exist to-day, as at common law, without material alteration. The ancient wrong of *disturbance of tenure*, which consisted in breaking the feudal tie of lord and tenant, has become obsolete with the disappearance of the feudal system of land tenure. The disturbance of public rights, as of a highway or a public right of common or of fishing, may be either a private nuisance, remediable by the individual whose right is interfered with, or a public nuisance, or purpresture, remediable by the state. See **EASEMENT**; **NUISANCE**; **PROFIT**; **TRESPASS**; **ETC.**; and consult the authorities referred to under **EASEMENT**.

#### **DISTURBANCE OF PUBLIC WORSHIP.**

A modern statutory offense, which has in the United States generally superseded the common-law offense of brawling (q.v.) in church. As generally defined, it consists in any willful interference, by acts or words, with the good order of persons assembled for religious worship, whether within a consecrated place of worship or elsewhere. The offense may be committed by a person present in the place of worship or by noisy conduct on the outside, and to constitute such acts or conduct a disturbance it is not necessary that the congregation assembled shall at the time be engaged in worship. It is sufficient if they are assembled for that purpose. The offense constitutes a misdemeanor, punishable by fine or imprisonment. It is not such a violation of private rights as to furnish grounds for an action for damages, unless it be habitual or so persistent as to amount to a nuisance. In that case the remedy by action lies in the hands of the trustees or other officers in whom the possession of the place of worship is vested. See **NUISANCE**.

**DIS'TYLE** (from Gk. *duō*, *duō*, two + *stylos*, *stylos*, column). In classic architecture, a composition showing two columns in front. When these stand between antæ or the ends of projecting side walls, the building is called *distyle in antis*.

**DISUSE**. One of the negative, but yet important, factors of evolution is disuse. Its significance was first pointed out by Lamarck in his first law of evolution, wherein he says that the constant lack of use of an organ "imperceptibly weakens it, causes it to become reduced, progressively diminishes its faculties, and ends in its disappearance." An example he gives of the reduction and loss of organs or limbs is that of snakes, which by change of habit from originally running to gliding directly along the

... we acquired greater length of body, legs, being thus disadvantageous to them, have disappeared by atrophy.

He also instances the loss by disuse of teeth in the baleen whales and in birds, and in the anteater, "whose habit of not masticating its food has been for a long time established and preserved in its race." He calls attention to the small reduced forelegs of the kangaroo, which "have remained thin, very small, and weak," and especially to the whale, saying: "Indeed, since the enormous length of time during which these animals have lived in the depths of the sea, never using their hind feet in seizing objects, their disused feet have wholly disappeared, as also their skeleton, and even the pelvis serving as their attachment."

Lamarck taught that the effects of disuse are inherited—a doctrine maintained by Darwin, who remarks: "I think there can be no doubt that use in our domestic animals strengthens and enlarges certain parts, and disuse diminishes them; and that such modifications are inherited," adding that in free nature "many animals have structures which can be explained by the effects of disuse." See USE; INHERITANCE.

Darwin also calls attention to the absence in many male dung beetles, including the *ateuchus* or "sacred" beetle of the Egyptians, of the anterior tarsi or feet, and this atrophy he thinks it safe to regard "as due to the effects of long-continued disuse." The same may be said of the reduction and loss of the fore tarsi of butterflies of the family *Nymphalidæ*. For cases of the loss of eyesight, of eyes, and the optic nerves and lobes in animals living in darkness, see CAVE ANIMALS.

Cases of the modification of animals by disuse occur in nearly every group. Among the mollusks it is noticeable in those bivalves, such as *Mytilus*, *Cardium*, etc., which live attached to other bodies. The oyster was originally equivale and capable of freely moving, but by disuse, owing to change in its ancestors to a fixed mode of life, it has lost its siphons, its foot, and the shells are of unequal size. It is so with the fresh-water mussel (*Mülleria*) of South America, which has acquired sedentary habits. It is the case in a still more marked way with the barnacles. Among insects there are countless instances of the reduction and partial or total loss of limbs in woodborers, in the grubs of many beetles living in seeds, nuts, etc.; in the larvæ of gallflies, of ants, wasps, bees, and in the larvæ of the ichneumon flies. If, as is very clearly the case with insects, we also attempt to explain the loss of limbs in the two-legged *Bipes*, *Chirotæ*, or the entirely legless *Amphisbæna* and the glass snake (*Ophiosaurus*), we shall see that it is evidently due to disuse and its inherited effects. Reasoning from this to the origin of the order of snakes, it becomes apparent that they have diverged from the lizards, and that Lamarck was right when he attributed their origin to such a cause. (See DEGENERATION.) The majority of snakes possess no trace of vestigial legs, the exception being the boas, in which there are two minute hornlike projections from under the scales and the hinder pair of limbs. Disuse has also made its mark in the running birds, the emu, ostrich, and cassowary, where the wings have by disuse retrograded, and as a compensation the legs and particularly the toes have become adapted for a cursorial mode

of locomotion. Other examples of disuse are the loss of the thumb in the thumbless ring monkey (*Colobus*) of Africa, and the spider monkey (*Ateles*) of Central and South America.

It is to be observed in these cases of the reduction and loss of digits that it is generally complete and thoroughgoing; there are no vestiges left as seen in the two-toed ostrich and the three-toed moa, apteryx, emu, and cassowary. The reduction is complete and is probably due to the high antiquity of these birds. That this is the case is suggested by the presence of the two splint bones of the horse, while the bones of the two other toes which began to be lost at an earlier geological age have entirely lapsed. In the potto (*Perodicticus*), a lemur which has partly lost the index finger, there is a distinct vestige left, the reduction having apparently taken place late in the phylogeny of this form.

In the case of the loss of wings in insects, of which there are so many cases, we have all grades of reduction. Some are completely apterous, with no vestiges of wings; in others there are little flaps left. The absence of wings in all these cases is clearly the result of change in the surroundings, or mode of life, as the wingless beetles, etc., which live under stones, or burrow in the ground.

A very interesting question here arises: Could these losses ever be restored? When we consider forms like the stick insect, whose ancestors of the Carboniferous period had large, well-developed wings; or the flea, and the braula, the sheep tick (*Melophagus*), and the bat tick (*Nycteribia*), it seems impossible that they could be restored to their ancestral winged form, even if the attempt were made to do so artificially in a laboratory of experimental evolution. Other cases are the loss outright of the collar bone in running mammals like the horse and most carnivora, of the canines in rodents, and all the teeth in the anteaters. It may be considered as contrary to the course of nature to suppose that these structures, once lost, and lost, could ever be restored. See DEGENERATION.

Here arises a question: Are there examples of the replacement by entirely new structures of organs lapsed by disuse?

The clearest case is that of the duckbill of Australia. Poulton has shown that the embryo duckbill has for a brief season the rudiments of three teeth in each upper maxilla, but that these are very soon lost, while their place is occupied by the posterior set of the eight horny plates situated in the upper and lower jaws, two upon each side of each jaw. The calcified true teeth of *Ornithorhynchus* became, Poulton thinks, unsuited to the needs of the animal when it adopted a mode of life in which large quantities of sand were necessarily taken into the mouth with the food, when it first fed upon insect larvæ, etc., which it dug with its broad bill out of the mud and sand at the bottom of streams. "Under such circumstances two things might happen: the true teeth might be protected from the effects of wear by continuous growth from persistent pulps or by a continued succession; or a constantly growing horny plate might be developed from the oral epithelium and might be substituted for the true teeth." See DUCKBILL, and illustration of teeth thereunder.

A less satisfactory example is that of the replacement of the horny teeth of the tadpole by the teeth of the frog or toad. But Nature as a rule gets her new organs by a more economical

and rapid method, i.e., by change of function of the same organ, which, owing to a change of habit, loses its original use and becomes modified to carry on entirely different functions. See FUNCTION CHANGES.

**DISVEL'OPED**, or **DEVEL'OPED** (from OF. *desveloper*, to unfold). In heraldry, a term applied to the colors of a regiment or noble house, when flying.

**DITCH** (ME. *diche*, AS. *dīc*, dike, Icel. *dík*, MHG. *tich*, ditch, Ger. *Teich*, pool; connected ultimately with Gk. *τείχος*, *teichos*, wall). 1. In agriculture, a trench made along the sides of fields, or following the contour of the land, to collect and remove the excess of water. In ordinary farm operations ditches are largely constructed by hand, but efficient ditching machines are found in the market. In modern practice open ditches have been largely superseded by underground tile drains, thus effecting a great saving of land and securing better drainage. In irrigated regions an open ditch is often used to convey the water from the main canals to the "laterals" which distribute it over the field. See DRAINAGE; IRRIGATION.

2. Part of the defense works of a fortified place (also called foss or moat). See FORTIFICATION; REDOUBT.

**DITHMARSCHEN**, dīt'mārsh-en, NORTH AND SOUTH (*Norder und Suder Dithmarschen*). The name given to the western portion of Holstein, Prussia, lying along the coast of the North Sea between the Eider and Elbe rivers. It has an area of about 500 square miles, lies very low, and is for the most part marshy, but with some good pasture land, from which the sea is kept by dikes. It was originally inhabited by Saxons and Frisians, who were subjugated and Christianized by Charlemagne in 804. In 1182 they regained independence, and in the latter part of the Middle Ages and at the time of the Reformation Dithmarschen formed a peasant republic, with a well-developed system of local autonomy. The inhabitants distinguished themselves by their bravery in defending their liberty against their neighbors. In 1559 they succumbed to the arms of Holstein and Denmark. In 1866 Dithmarschen, along with the rest of Holstein, was incorporated in Prussia. North and South Dithmarschen each still forms an independent district in the Prussian Province of Holstein. Pop., 1900, 86,019; 1910, 96,373. Consult: Dahlmann's edition of Neecorus, *Chronik der Dithmarschen* (Kiel, 1827); Volkmar, *Geschichte des Landes Dithmarschen* (Brunswick, 1851); Nitzsch, *Das alte Dithmarschen* (Kiel, 1862); Nehlsen, *Dithmarscher Geschichte* (Hamburg, 1894).

**DITH'YRAMB**. See DITHYRAMBUS.

**DITH'YRAM'BUS** (Lat., from Gk. *διδύραμπος*, *dithyrambos*, of uncertain etymology). An orgiastic hymn sung in honor of the god Dionysus, accompanied by music on the flute and a dance around the altar. The subject was originally the birth and life of Dionysus, but later other themes too were employed. Its development into artistic form took place at Corinth—according to another tradition at Naxos—and was attributed by the ancients to the mythical Arion. From the sixth century till about 300 B.C. the hymn was sung by a chorus of 50, generally dressed as satyrs, the companions of Dionysus. At Athens there were annual contests at the Greater Dionysia, Lesser Dionysia, Panathenæa, Thargelia, and Lenæa (see GREEK FESTIVALS),

between dithyrambic choruses entered by the 10 tribes. The prize in the earliest period was an ox, in the fifth century and later a tripod. Out of the dithyramb arose the choral portion of Greek tragedy. After the development of tragedy the dithyramb was still composed independently, e.g., by Philoxenus, Bacchylides, and Pindar. Of the hymns of the dithyrambic writers only fragments are preserved. Consult Smyth, *Greek Melic Poets* (London, 1900), and Schmidt, *Zur Geschichte des griechischen Dithyrambus* (1901).

**DITMARS**, RAYMOND LEE (1876—). An American naturalist, born in Newark, N. J., and educated at the Barnard Military Academy, New York City, where he graduated in 1891. He then served as assistant curator of entomology at the American Museum of Natural History, in New York, for five years, as a reporter for the *New York Times* from 1897 to 1898, and thereafter as curator of reptiles at the New York Zoölogical Park; in 1902 he was also appointed curator of mammals. He made an especially careful study of reptiles and published the valuable *Reptile Book* (1907) and also *Reptiles of the World* (1910).

**DIT'TANY** (OF. *dittain*, *dictame*, Lat. *dictamnium*, Gk. *δίκταμνον*, *diktamnon*, dittany, from Gk. *Δίκρη*, *Diktē*, a mountain in Crete, where the plant grew in abundance), *Dictamnus*. A genus of plants of the family Rutaceæ. The common dittany, also called bastard dittany or fraxinella (*Dictamnus albus*), a native of sunny mountains and rocks and dry mountain forests of the south of Europe, especially in calcareous soils, is cultivated as a garden flower. It is a perennial, with stem 1½ to 3 feet high, unbranched, bearing a few pinnated leaves, and terminating in a beautiful erect raceme of 10 to 20 flowers of a fine rose color, with darker veins, more rarely white. When in flower, the plant diffuses a powerful fragrance from its numerous oil glands, and during dry, hot weather exhales a quantity of volatile oil the sudden combustion of which makes a slight flash when ignited by a candle. The root is thick, white, and very bitter, and was formerly in high repute in medicine as a tonic stimulant. Dittany of Crete (*Origanum dictamnus*), used as a febrifuge, and the dittany of the United States (*Cunila origanoides*), are very different plants, belonging to the family Labiatae. The latter is found upon dry hillsides from New York to Georgia and westward to Arkansas. The plant has smooth, heart-shaped leaves, and clusters of small white or purplish flowers.

**DITTENBERGER**, dīt'ten-bērĕ-ēr, WILHELM (1840—). A German classical scholar, born at Heidelberg. He studied at Jena and Göttingen and in 1874 was appointed professor of classical philology at the University of Halle. His publications include: *De Ephebi Attici* (1863); *Inscriptiones Atticæ Ætatis Romanæ* (1878-82; vol. iii of the original edition of the *Corpus Inscriptionum Atticarum*, published by the Berlin Academy); *Sylloge Inscriptionum Græcarum* (1883; 2d ed., 3 vols., 1898-1901); *Corpus Inscriptionum Græcarum Græciæ Septentrionalis* (1892); *Orientis Græci Inscriptiones Selectæ* (2 vols., Leipzig, 1903-05). Consult Larfeld, *Griechische Epigraphik* (Munich, 1914).

**DITTERS**, dīt'tĕrs (DITTERS VON DITTERSDORF), KARL (1739-99). An Austrian violinist and composer. He was born in Vienna and

studied under König, Ziegler, Trani, and Bono. Much of his education was due to the interest in him of Prince Joseph of Hildburghausen, whose orchestra Ditters afterward led. He was a brilliant violinist and won wide success, the tour with Gluck (1761) establishing him firmly as a violin virtuoso. He was a prolific composer in almost every department of composition, but, excepting his charming comic opera *Doktor und Apotheker* (1786), nothing of his work remains in use. He had the misfortune to have his undoubted gifts overshadowed by the brilliant genius of Mozart. His music is marked by correctness of style, fluency of expression, and beauty of melody. Few musicians of his day met with greater appreciation, had more honors conferred upon them, or held more honorable positions. He died at Castle Rothlhotta, near Neuhaus, in Bohemia. The best edition of his autobiography is that edited by Spazier (Leipzig, 1801), reprinted by E. Istel (Leipzig, 1909).

**DITTON, HUMPHREY** (1675–1715). An eminent English mathematician. He was for some years a dissenting clergyman, but through the influence of Sir Isaac Newton obtained a professorship in the new mathematical school at Christ's Hospital, where he remained through life. He and Whiston devised a new method for determining longitude at sea, but it was rejected by the Board of Admiralty. Ditton's death has been attributed to his disappointment. He was the author of mathematical works, including: *General Laws of Nature and Motion* (1705); *An Institution of Fluxions* (1706; 2d ed., 1726); *Treatise on Perspective* (1712); *Discourse on the Resurrection of Jesus Christ* (1714).

**DIU**, *dē-ō'* (Gujarati, from Skt. *dvīpa*, island, so called from the situation of the town). A seaport, situated at the eastern extremity of an island of the same name, separated from the peninsula of Kathiawar, Bombay Presidency, India, by a narrow strait (Map: India, B 4). Formerly a prosperous city of more than 50,000, it has lost its commerce because its harbor is growing shallower. It is fortified and has a tolerably safe harbor, with a general depth of 3 or 4 fathoms. The chief occupation is . . . . . The place has been in possession of . . . . . since 1535. The area of the island is about 20 square miles. Pop., 1900, 14,614.

**DIURETICS** (Lat. *diureticus*, from Gk. *διουρητικός*, *diourētikos*, promoting urine, from *διουρεῖν*, *diourein*, to urinate, from *διά*, *dia*, through + *οὔρεῖν*, *ourein*, to urinate, from *οὔρον*, *ouron*, urine). Medicines having the property of increasing the secretion of urine. They are of several classes: 1. *Vascular or cardiac diuretics*, which act by increasing arterial tension or the blood supply of the kidneys. These include all cardiac stimulants, important representatives being digitalis, caffeine, theobromine, diuretin, convallaria, scoparius, sparteine, apocynin, squill, and strophanthus. 2. *Refrigerant diuretics* include the salts of sodium and potassium, particularly the acetate, citrate, and bitartrate of potassium. 3. *Stimulant diuretics* are those which have a direct stimulating action upon the genitourinary tract; such as juniper, turpentine, copaiba, cubebs, oil of sandalwood, buchu, and cantharides. Some of these are extremely irritating and must be used very cautiously. 4. *Water* is a most important diuretic, increasing the amount of fluid in the blood.

Diuretics are used in conditions in which the quantity of urine is diminished; to aid the absorption of fluid in dropsy or collections of fluid in the body cavities, whether the result of inflammation, such as pleurisy, or of imperfect action of the heart, kidneys, etc.; to aid in the elimination of poisons; and to dilute the urine so as to make it less irritating in inflammations of the genitourinary tract, or to prevent the formation of calculi, or stones, in the kidneys or bladder. Many of the diuretics mentioned are described in separate articles. Some diaphoretics, such as pilocarpine, at times act as diuretics. The action of this class of medicines is very uncertain, depending largely upon the individual, and varying in the same person under different conditions.

**DIURETIN** (from Gk. *διουρεῖν*, *diourein*, to urinate), or SODIO-SALICYLATE OF THEOBROMINE,  $C_7H_7NaN_4O_2 + NaC_7H_5O_3$ . A valuable diuretic, especially in cases of dropsy of cardiac origin; but, like all drugs of its class, very uncertain in its action on the heart and kidneys; to aid in stimulating the cells of the kidney. It occurs as a white powder which is freely soluble in warm water and remains dissolved after cooling. See SALICYLIC ACID.

**DIURNAL MOTION** (Lat. *diurnalis*, daily, from *diurnus*, daily, from *dies*, day). The apparent daily motion of a heavenly body caused by the rotation of the earth on its axis. See AXIS; EARTH; PLANETS.

**DIV**. See DEV.

**DIVAN**, *di-vân'*. A Persian word having various significations, being used in the sense of a muster roll, a register of payments or accounts, or a place for the preservation of a register; and it is also applied to a collection of poems or songs by one and the same author. Goethe uses it in this sense in his *Westöstliche Divan*. Divan means next an administrative board; the council of state at Constantinople is . . . . . *humayun* ('most illustrious divan'). Finally, divan is the name for the state or reception room in Oriental palaces. Along the walls of the room are ranged low couches, covered with rich carpets and provided with cushions. Hence the name "divan" is used for a kind of couch or sofa.

**DIVER**, *div'ər*. The name of several water-birds, especially loons and grebes, remarkable for quick diving—in some cases so quick as to dive at the flash of a gun and escape the shot. The whole order (Pygopodes) to which these birds belong is often spoken of as "divers." See LOON.

**DIVER**, THE. A poem by Schiller (q.v.).

**DIVERS**, *di'vərz*, EDWARD (1837–1912). An English chemist and educator, born in London, and educated at the Royal College of Chemistry and at Queen's College, Galway, Ireland. In 1870 he lectured on medical jurisprudence at the Middlesex Hospital Medical School; and he served as professor of chemistry at the Imperial College of Engineering in Japan from 1873 to 1882, when he was chosen principal of that institution. He was vice president of the Chemical Society (1902) and president of the chemical section of the British Association and of the Society of Chemical Industry (1905). He is author of several chemical researches.

**DIVER'S PALSY**. See CAISSON DISEASE.

**DIVERTIMENTO**, *It. pron. dé-vâr'tè-mân'tò* (It., diversion). 1. A term originally applied to the dances interpolated between the scenes



of the older French opera (*Divertissement*). 2. A composition somewhat like the modern suite (q.v.). It consists generally of five or six movements in free style, but the music is always of a simple character. 3. An entr'acte in an opera. 4. An episode in a fugue.

**DIVES**, *dī'vēs* (Lat., rich). The word used in the Vulgate version for the rich man, in the story of Lazarus in Luke xvi, and thence often taken as a proper name, although it is in reality only a descriptive term.

**DIVICIACUS**. See **DIVITIACUS**.

**DIVIDE** (Lat. *dividere*, to divide). In physical geography, the crest line between the slopes of two . . . systems. The term is used, mostly in . . . States, synonymously with watershed.

**DIVIDEND** (Lat. *dividendus*, to be divided, from *dividere*, to divide). A fund, made up of principal or profits, set apart for distribution among a number of persons ratably entitled thereto; also the portion or share of each person so entitled. In practice the term is not in common use to describe a complete fund distributed once and for all to the claimants or owners, as in the division of partnership assets or the distribution, upon an accounting, of the assets in the hands of an executor or administrator; but it is rather employed to denote the sum available for partial or periodical payments out of such assets or out of current earnings. In this restricted sense it is entirely appropriate to the portion of the assets of an insolvent, or of a company in process of winding up, which is realized from time to time by the trustee or receiver and distributed among the creditors or shareholders. The most common use of the term, however, is to describe those profits or earnings of a corporation or joint-stock company which are set apart for distribution among the members and stockholders.

It will be noticed that such assets and earnings while yet unappropriated are not dividends, and that it is their formal appropriation to the purpose of distribution which gives them that character. As soon as this has been done, and not before, they are treated by the law as the property of the persons entitled thereto under the terms of the appropriation, and such persons may accordingly demand and recover them as "money had and received to their use."

As applied to corporations, the term "dividend" has been defined to be "that portion of the profits and surplus funds of the corporation which has been actually set apart by a valid resolution of the board of directors, or by the shareholders at a corporate meeting, for distribution among the shareholders according to their respective interests, in such a sense as to become segregated from the property of the corporation and to become the property of the shareholders distributively."

The declaration of dividends is one of the usual powers of directors, and, unless controlled by the charter or by-laws of the corporation, they may usually fix the amount of the dividend, and the time and place of payment, at their sole discretion, subject only to the obligation of good faith with the stockholders. Dividends cannot usually be declared out of the capital, but only from the profits; but there is no obligation on the directors to appropriate all or any particular portion of the profits to this purpose, though the contrary has been held in England. It has also been held in England

that dividends must be payable in money; but in the United States dividends are often paid in the stock, bonds, or scrip of the corporation. When dividends declared from time to time do not exhaust the profits, the surplus thus accumulated may be appropriated in whole or part as an "extra dividend" or bonus.

As between a person having a limited interest in corporate shares, as a life tenant, and the person entitled thereto in the future, the question may arise as to whether dividends earned but not declared during the ownership of the shares by the former, or dividends declared out of accumulated earnings, belong to the former as profits or to the latter as capital. Commonly this is solved by applying the rule, previously laid down, that no one becomes entitled to earnings until they have been appropriated in the form of a dividend. It is usually held also that extra dividends declared out of surplus earnings shall always be regarded as profits in the same way as those declared out of current earnings. See **CORPORATION**; **DIRECTOR**; **STOCKHOLDER**; **STOCK**; **DEBENTURE**; and the authorities referred to under those titles.

**DIVIDERS**. See **COMPASSES**.

**DIVIDING ENGINE**, or **RULING ENGINE**. A machine devised to rule fine lines at regular intervals by means of a diamond point or other sharp edge. The most common use of such machines is for the purpose of dividing the circumference of a circle into degrees and minutes or other divisions as is necessary in the construction of surveying and astronomical instruments, micrometer screws, spectrometers, and other physical instruments, as well as in many commercial machines; and also for the purpose of dividing a length into aliquot parts as in the making of meter rods and similar instruments. Another use to which they are put is that of the preparation of diffraction gratings (q.v.), in which it is necessary to have the means of ruling a great number of lines, exactly parallel and at exactly equal small intervals apart. Gratings are made with as many as 100,000 lines in a distance of five or six inches.

The first instrument for the ruling of gratings was made by Joseph von Fraunhofer (q.v.); others have been made by Rutherfurd, Rowland, and Michelson; but all are based on the same general principle. The machine consists of a cylinder on which a screw thread is cut and which carries a large nut, the two together being like an ordinary bolt and nut. The ends of the screw are held in yokes, so that it can turn on its axis, and the nut is held on "ways" parallel to the screw. Thus, as the screw is turned by a crank or otherwise, the nut advances or recedes. A cutting edge is set at some point above the screw, in such a manner that it can be made to make a line at right angles to the axis of the screw. The piece of glass or metal on whose surface the rulings are to be made is attached to the nut, and the operation is as follows: A line is made by the cutting edge; the screw is turned through a certain fraction of a complete revolution, e.g., one-thousandth, thus carrying the nut and the surface forward a small distance; a second line is ruled; the screw is again turned through the same angle as before; a third line is ruled, etc. Thus, if the pitch of the screw is 20—i.e., if there are 20 threads or spirals on the screw in each inch along its length—there will be 20,000 lines per inch ruled on the grating surface. The nut is split in two,



the halves being hinged at the top and having below two projections, or "wings." When the machine is to be used, these are clamped together. At the end of the ruling the wings are opened, and the nut, being thus released from the screw, can be pushed back to the starting point.

It is evident that the machine must be rigid, the "ways" exact, the screw of perfectly uniform pitch, the turning of the screw regular, the cutting of the line exactly straight. All modern machines are automatic; a large toothed wheel is attached to the screw at one end, and this turned by levers, one tooth at a time; the cutting edge is a diamond point which is allowed to drop on the ruled surface, is drawn across, then lifted, pushed back to the original position, etc. There are always periodic errors in the use of any dividing engine, occasioned by irregularities in the toothed wheel, the end of the screw which butts against some fixed support, and elsewhere. These may be counteracted by a device due to Rowland which depends upon the action of a lever resting on a cam attached to the axis of the screw. The end of the lever is rigidly fastened to a rod which is parallel to the screw, and to which is attached, by means of a short crank, a framework supported under the screw and free to move horizontally. Part of this framework consists of two steel rods parallel to the screw, between which the two "wings" of the nut can just move freely, as the nut is carried forward by the screw. Thus, if the cam raises its lever, the rod will turn, moving the framework holding the wings of the nut, and thus giving the nut a slight turn independent of the action of the screw. It is a matter, therefore, of trial to find a cam of such a shape, and to place it on the axis of the screw in such a position, that by its motion the irregular motion of the nut due to the irregularities of the machine may be made perfectly regular. The circular dividing engine used in making the scales of various instruments of precision likewise depends upon an accurate screw, and gear wheels and various refinements have been introduced in the design and construction of such instruments whose calibration curves are studied with great care. For a description of the construction of a "perfect" screw, reference should be made to the article "Screw," by Rowland, prepared for the ninth edition of vol. xxi of the *Encyclopædia Britannica*. A full description, with plates, of Rowland's dividing engine is given in *The Collected Papers of Henry A. Rowland* (Baltimore, 1902), in which the article on "Screw" is also reprinted. An interesting description of a novel type of circular dividing engine and its calibration by Stamper and Hall will be found in *Physical Review*, vol. xxx, No. 4.

**DIVI-DIVI**, dē-vē-dē-vē (Galibi or Carib word), or **LIBIDIBI**. The cured pods of *Cæsalpinia coriaria*, a tree which grows on the coasts of (the) Caribbean, and other parts of tropical America. They have been long used there for tanning, and have recently acquired importance as an article of commerce. Divi-divi is one of the most astringent substances known. The tree reaches a height of 20 to 30 feet, and produces about 100 pounds of pods annually. The pods contain tannin and gallic acid. It is said to tan leather with great rapidity. The United States imports annually about 300,000 pounds. See *CÆSALPINIA*.

**DIVINA COMMEDIA**, dē-vē'nā kōm-mā'-dē-ā. See DANTE.

**DIVINATION** (Lat. *divinatio*, from *divinare*, to divine, from *divinus*, divine, from *divus*, deity). A term employed to describe the quest of a knowledge of secret things, past, present, or future, by various supernatural methods, principally oracular responses and omens. As the origin of the word indicates, the idea is based on the assumption that human intelligence may obtain knowledge from the divine mind through media affected by divine influence. The Greek term *μαντική* (*tekhē*) suggests the inspired intermediary *μάντις* ('seer'), a word which Plato and the Greeks associated with *μανία* ('inspired frenzy'). The contact of the divine mind with human intelligence was believed to be accomplished either through a medium directly, or by signs and omens which were interpreted by the medium. The Stoic philosophers recognized this difference in method (Cicero, *De Divinatione*, i, 6, 33, and ii, 11), and designated the first *ἀρεχρος*, *naturalis* ('artless'), i.e., the direct or natural method; and the second *ἔντεχρος*, *artificiosa*, i.e., the artificial method. Bouché-Leclercq terms the first the intuitive and the second the inductive method, because the artificial class admits of some spontaneity and the natural something artificial.

The natural, the intuitive, method is very familiar as represented by oracles, a term used to denote both the seat of divination and the responses themselves. For these responses the seats of worship of divinities were regarded as favorite localities and were generally marked by some peculiar physical characteristic, as a cleft in the ground whence an exhalation arose by which the medium was made to pass into a trance. There were several methods in which information from the divinity was communicated by the oracles. *Divination by dreams* (oneiro-mancy) required experience in dreams and the interpretation thereof. Persons desiring revelation by this means would go to sleep in places thought to be haunted by dreams, such as tombs of heroes and temples of divinities. As the body must be inert and the mind passive, various means were employed to accomplish this, as refraining from wine and food for a certain period. Means were also taken to summon the dreams by incantations and by unusual conditions of sleeping, as when one lay on the skin of a ram slain by him. This method was known as incubation (*ἐγκοιμιαις*). Such was the oracle of Amphiaraus at Oropus, near the spot where the hero became a god. Of this kind the most familiar oracles were healing shrines connected with the temples of Æsculapius. *Necromancy* was the method whereby revelation was conveyed by the shades of the dead who were summoned for the purpose. In Homer, Odysseus goes to the entrance of the lower world to consult the shade of Tiresias. These oracles were given at places recognized as approaches to the lower world, as Lake Aornos in Thesprotia, and Lake Avernus near Cumæ in Italy. *Chresmology*, or divination by frenzy (*vaticinatio* or *divinatio per furorem*), was the revealing of the will of the divinity by seers. Being in a state of frenzy, superinduced by exhalations or drafts of water from certain streams, or of blood, as of a lamb, they spoke forth the prophetic words either from a presentiment or an inspiration by the divinity, or from becoming, as was fancied, the incarnation of the divinity

for the time being. The most famous oracle of this class was at Delphi, situated on the side of Mount Parnassus in Phocis, which, originally belonging to Gæa, then to Themis, the representative of law and order, finally came into the possession of Apollo, whose priestess, Pythia, gave his answers by means of her cries.

The artificial or inductive methods of divination admit of the following classification: *Divination by instinctive acts of animals*. Under this heading is therefore placed ornithomancy, ichthyomancy, etc. This refers to revelations obtained from the behavior of birds and fishes, particularly of the former, who, being in the heavens, come close to the divinities and can act as messengers. With these should also be classed the instinctive or unconscious acts of man. Such was the divination by omens, so familiar to the Romans. The well-known story of Crassus is an illustration. Starting on his ill-fated expedition against the Parthians, he heard a man selling figs from Caunus, and crying "Cauneas," which sounded like *Cave ne eas* ('Beware of going'). Here we may also place the modern divining rod (q.v.) which is said to bend when held over concealed springs of water or mineral deposits. This custom is known in England as "dowsing." (Consult Murray, *New English Dictionary*.) *Divination by haruspication*. This method was the interpretation of the divine will by studying the entrails of victims. Practiced in very remote antiquity in the East, in Egypt, Cyprus, and Etruria, it was familiar to the Greeks of the fifth century B.C., but not in Homeric days. It passed from Etruria to Rome, where it served the purposes of statesmen (Cicero, *De Divinatione*, ii, 12). The nearest approach to this in recent days is palmistry, or reading the lines of the hands, and the old "reading of the speal bone," called omoplatoscopy or scapulimancy, which is the inspection of the lines in the shoulder blade. *Divination by fire* (empyromancy). This consists in observing the effect of fire from the altar on wood, or on the offering, or again in watching the movements of the smoke and the wine of a libation. *Divination by water* (hydromancy) consisted in the observation of objects cast into water. *Divination by lots* (cleromancy) was a method which required a movement consciously begun and directed by chance. Here may be placed *axinomancy*, which is the consideration of the movements of an axe placed on a post; *coscinomancy*, or the observing of the results of the turning of a sieve hung on a thread; or, again, *dactylomancy*, or the interpretations of the oscillations of a ring hung over a circular vase against which it strikes. This is a method of great antiquity and is found in Homeric days. Among the Romans *sorilegium*, or casting of lot, belonged to this experimental form of divination. Small tablets of wood, bone, or bronze were inscribed with various sayings and when shuffled and drawn gave the prophecy. A number of them have come down to our own times and are described in *Corpus Inscriptionum Latinarum*, vol. i, pp. 268-270. The term *sortes* was also given to selections from books used for a similar purpose. Compare with this the chance reading of the Scriptures. Lines from the great poets, particularly Vergil, were also employed as *sortes Vergilianæ*, as mentioned by Spartianus in his *Hadrian II*. In England Charles I is said to have opened to *Aeneid*, iv, 615, when consulting Vergil in the Bodleian Library at Oxford. Dice

were also used by the Romans in this way. *Divination by meteorology* is represented by the study of lightning flashes and interpretation of them. Such were the *signa ex cælo* interpreted by the augurs and haruspices. *Divination by astrology* was the most important in antiquity and consisted of predictions made after observing the heavenly bodies. It arose among the Chaldeans, then passed to the Greeks, and finally to the Romans, among whom the term for astrologers was *Chaldæi* or *mathematici*. See AUGURIES.

**Bibliography.** Consult: Cicero, *De Divinatione*; Plutarch, *De Pythæ Oraculis* and *De Defectu Oraculorum*; Mezger, "Divinatio," in Pauly, *Realencyclopædie*, vol. ii, pp. 1113-85 (Stuttgart, 1842); Maury, *Histoire des religions de la Grèce antique: La divination et les oracles*, vol. ii, pp. 431-539 (Paris, 1857); Schneider, *Die Divinationen der Alten mit besonderer Rücksicht auf die Augurien der Römer* (Külthen, 1862); Fontaine, *De Divinationis Origine et Progressu* (Rostock, 1867); König, *Das Orakelwesen im Alterthum*, Programm (Creifeld, 1871); Hoffmann, *Das Orakelwesen im Alterthum* (Stuttgart, 1877); Bouché-Leclercq, *Histoire de la divination dans l'antiquité* (4 vols., Paris, 1879-82); also article "Divination," in Daremberg and Saglio, *Dictionnaire des antiquités*; Dechambre and Thomas, article "Divination," in *Dictionnaire des sciences médicales*, vol. xxx, pp. 24-96 (1884); Bossier, *Documents assyriens relatifs aux présages* (Paris, 1894); Holliday, *Greek Divination* (New York, 1913).

**DIVINATION BY CUP.** See CUP, DIVINATION BY.

**DIVINE RIGHT.** A term of ancient origin, which came into general use in the seventeenth century during the factious contentions of English Royalists and Parliamentarians. The Royalists maintained that, as "the Lord's anointed" and the immediate representative of the Deity, all power and government were vested in the king, who "could do no wrong"; a doctrine which relieved him from human responsibility. The Parliamentarians contended that the exercise of political power sprang from the will of the people, by what was termed "the social contract." The opponents of divine right included Milton, Algernon Sidney, and Harrington, and its chief supporters were Hobbes, Salmasius, and Sir Robert Filmer, whose *Patriarcha* contains a complete exposition of the theory. The idea can be traced through the Middle Ages and beyond, in the assumed "divine authority" of the magistracy; in the history of the Roman Catholic church it is found in the doctrine of the Pope's infallibility. The settlement of the crown on William and Mary ended the British controversy, but a similar controversy was revived in the discussions which caused the French Revolution.

**DIVINE SONG.** See BHAGAVAD-GITA.

**DIVINE TRAGEDY,** THE. A dramatic poem by Longfellow (1871), forming the first part of his trilogy *Christus*.

**DIVING** (from *dive*, AS. *dyfan*, causative of *dūfan*, to plunge). The act of working under water—either with or without mechanical aids to enable respiration—as in pearl and sponge fishing, the raising of sunken vessels, the laying of subaqueous foundations, or other operations under water. Formerly diving operations were confined mostly to pearl and sponge fisheries and were performed by divers who plunged beneath

the water, remained as long as they were able to do without respiration, and then returned to the surface with their load. It has been asserted that the pearl divers of the East acquired by practice the power to remain under water for 15 or 20 minutes. There is absolutely no truth in such assertions, as no such endurance is possible; two, and sometimes three, minutes under water is the limit of endurance of the most skillful divers unaided by mechanical means to support respiration. Most divers suffer severely from the continual efforts, in holding the breath; bloodshot eyes and the spitting of blood are common among them. This rude method of diving is but little used now, even in the pearl and sponge fisheries, where it is particularly applicable. Diving operations are now performed by means of diving bells or special diving dress.

**Diving Bell.** The *cacabus aquaticus*, or aquatic kettle, described by Taisnier as having been used by two Greeks in Spain, at Toledo, in 1538, in the presence of the Emperor Charles V and a multitude of spectators, is one of the earliest reliable accounts of a diving bell. From his description this must have been similar in principle and construction to the modern diving bell, but of clumsy dimensions, and wanting in efficient means of renewing the supply of air. Dr. Halley's diving bell, devised about 1714, was a wooden chamber, open at the bottom, where it was loaded with lead to keep it perpendicular in its descent. Strong pieces of glass were set in the upper part to admit light. Casks filled with air and loaded with lead were let down with the bung-hole downward; and from these a supply of air was drawn by means of a hose. Halley on one occasion with four companions descended to a depth of 54 feet and remained one and a half hours. The form of diving bell now in use was first constructed by Smeaton for underpinning the foundations of a bridge over the Lyne at Hexham in 1778 and then for the works at Ramsgate Harbor, England. The bell was of cast iron and weighed 50 hundredweight; its height,  $4\frac{1}{2}$  feet; length, the same; and width, 3 feet. It sank by its own weight and was lighted by stout pieces of bull's-eye glass firmly cemented by brass rings near the top.

The principle of the diving bell will be easily understood by floating a piece of lighted candle or a wax match on a cork and then covering it with an inverted tumbler and pressing downward; the candle will descend below the level of the surrounding water and continue burning for a short time, although the tumbler be entirely immersed. The reason is obvious enough; the air in the tumbler, having no vent, remains in it and prevents the water from occupying its place, so that the cork and candle, though apparently under water, are still floating and surrounded by the air in the tumbler; the candle continues burning until the oxygen of the air is exhausted, and then it goes out, as would the life of a man under similar circumstances. If vessels full of air, like the barrels of Dr. Halley, were submerged, and their contents poured into the tumbler, the light might be maintained; but this could better be done if a tube passed through the tumbler, and air were pumped from above through the tube into the tumbler.

The modern diving bell, which is made of steel plates and is used chiefly for preparing the ground to receive massive concrete blocks used

in harbor construction, is supplied with air in this manner. It must be remembered that air is compressible and diminishes in bulk in proportion to the pressure, so that at a depth of about 33 feet in water it would occupy half the space it filled at the surface; if the inverted tumbler were carried to this depth, it would be half filled with water. A considerable quantity of air has, therefore, to be pumped into the diving bell merely to keep it full as it descends; the air thus compressed exerts a corresponding pressure and would rush up with great force if the tube were open and free. This is prevented by a valve opening downward only. When the diving bell has reached its full depth, the pumping is continued to supply air for respiration; and the redundant air overflows, or rather underflows, by the open mouth and ascends to the surface in bubbles. The diving bell is provided with a platform or seat for the workmen and suspended from a suitable crane or beams projecting from a barge or pier; men above are stationed to work the pumps and attend to the signals of the bellman. These signals are simply made by striking the sides of the iron diving bell with a hammer, and as sound is so freely communicated through water, they are easily heard above, or telephone communication may be established. Owing to their great weight and clumsy operation, diving bells are now seldom used in subaqueous operations, the modern appliance being the diving dress or diving armor. A recent application was in connection with the construction of the naval harbor works at Dover, England.

An account of early diving bells and apparatus will be found in Gerland and Trautmüller's *Geschichte der physikalischen Experimentierkunst* (Leipzig, 1893).

**Diving Dress.** In Schott's *Technica Curiosa*, published in 1664, is described a *lorica aquatica*, or aquatic armor, which consisted of a leathern dress, to protect the diver from the water, and a helmet. In 1721 Halley describes a contrivance of his own of nearly the same kind; its object was to enable the diver to go out from the bell and walk about; he was to be provided with a waterproof dress and a small diving bell, with glass front, as a helmet over his head, which was to be supplied with air by means of a tube from the diving bell. In 1798 Kleingert of Breslau invented a diving dress available for depths up to 20 feet. The head and body of the diver were encased in cylindrical tin-plate armor and his legs in leather breeches. Fresh air was conveyed to him and the vitiated air was removed by means of pipes.

In 1828 August Siebe in England devised an open-helmet diving dress, having a copper helmet and breastplate, with attached canvas jacket below which the air was allowed to escape, but to avoid the admission of water the diver was forced to keep a vertical position. In 1839, while working on the wreck of the *Royal George*, Siebe improved his dress, which straightway became standard practice and has since remained in use in Great Britain with few modifications and is essentially the type used in the United States. This form, a closed type of dress, is a waterproof costume with helmet of tinned copper, having circular glasses in front, valves to admit and discharge air, and a signal line to allow communication with those above water. The weight of the dress is about 275 pounds.

On the continent of Europe apparatus known

as the Rouquayol-Denayrouze apparatus from its inventors was first used in 1864. It is a steel air reservoir carried on the diver's back and supplied from a pump. It is more complicated than the usual form, but obviates the risk of the diver being blown to the surface under certain conditions.

In 1880 Fleuss invented a dress weighing only 20 pounds, which since it originally appeared has been much improved. This has no life line or air pipe, but a copper cylinder fastened to the back, carrying a supply of compressed oxygen with a suitable reducing valve and, under certain circumstances, apparatus for mixing air.

Other modifications and improvements of this idea have been made, and while it is not yet available at extreme depths the diver has great freedom of movement, being independent of hose and pump. The carbonic acid exhaled by the diver is absorbed by caustic soda in a receptacle fixed above the copper cylinder, while the air purified is breathed over and over again. In this dress the diver may remain several hours below the surface.

For lighting the diver's surroundings arc and incandescent electric lights are used, as well as improved oil lamps supplied with air by force pumps. Slatcs and signal lines and latterly telephones, a most important and desirable modern innovation, are used for purposes of communication. The greatest depth to which a man may descend with safety is 204 feet, equivalent to a pressure of 91½ pounds per square inch. This distance, actually accomplished by James Hooper at the wreck of the *Cape Horn* off Pichidanque, South America, is usually considered the record depth.

On all ships of the United States navy, except very small ones, there is a complete diver's outfit. Nearly all gunners' mates are now instructed in diving, and all recently appointed gunners and boatswains are conversant with the work, as are also the carpenters. Divers are used for examining the bottom or cleaning it, overhauling the strainers of submerged pipes, scraping the propellers, examining chains, looking for articles lost overboard, etc. Men who are qualified divers are given \$1.20 for each hour actually spent in diving in addition to the ordinary pay of their rating.

**Bibliography.** For a popular description consult Dunville-Fife, *Submarine Engineering of Today* (London and Philadelphia, 1914); also Boycott, *Compressed Air Work and Diving* (London, 1909); British Admiralty, *Report of the Committee on Deep-Water Diving* (ib., 1907).

**DIVING BEETLE.** An aquatic predacious beetle of the family Dytiscidæ. These beetles are flat, oval, and, when not disturbed, hang head downward in the water with only the tip of the abdomen touching the surface. They may be distinguished by the threadlike antennæ. They are brownish black in color, sometimes with indistinct yellow markings. These beetles are very voracious and feed on other insects, worms, and even small fish, fly at night with ease, and frequently congregate about electric lights, and some forms make a sound both in and out of water. Their eggs are laid in the water and the larvæ are known as water tigers. The transformation of the larvæ is undergone in a cell in the earth. Nearly 300 species of this family are known. The two genera to which

the largest American diving beetles belong are *Cybister* and *Dytiscus*, distinguished by the disks on the tarsus, which are in four rows and similar in *Cybister*, while they are variable in *Dytiscus*. The medium-sized forms belong to the genera *Acilius* and *Colymbetes*, the former having the wings finely punctured, and the latter striated. The larvæ of all forms can easily be kept in confinement if fed on bits of cooked or raw meat. Consult Miall, *Natural History of Aquatic Insects* (London, 1903).

**DIVINING ROD** (often called *virgula divina*, *baculus divinatorius*, *caduceus* or wand of *Mercury*, rod of *Aaron*, etc.). A forked branch, usually of hazel, sometimes of iron or even of brass and copper, by which minerals and water are alleged to have been discovered beneath the surface of the earth. The rod, when suspended by the two prongs, sometimes between the balls of the thumbs, is supposed to show by a decided inclination the spot under which the concealed mine or spring is situated. The divining rod seems to have been known in all times, ancient and modern. It is clearly described by both Cicero and Tacitus, and an unbroken line of references to it can be traced from their days to this. Other powers are ascribed to the divining rod, but this is the chief. Many persons, even of some pretensions to scientific knowledge, have been believers in the occult power ascribed to this magic wand. Agricola, Sperlingius, and Kirchmayer all believed in its supernatural influence. Bayle, in his dictionary, under the word "abaris," gives some ingenious arguments both for and against the divining rod. In a work published in 1847 and 1851, entitled *On the Truth Contained in Popular Superstitions*, Dr. Herbert Mayo gives a curious collection of alleged discoveries made by this divining rod. Many are the possible explanations for this strange phenomenon, the facts of which cannot, seemingly, be disputed; even to-day some reputable scientists, Professors Barrett and Janet among them, accept these facts. Undoubtedly some natural cause or causes will in time be discovered that will throw light on this obscure phenomenon. For a full and interesting discussion of the subject, the reader must be referred to Professor Barrett's papers in parts xxxii and xxxviii (for 1897 and 1900) of the *Proceedings of the Society for Psychical Research*. Consult Pierre Le Brun, *Histoire critique des pratiques superstitieuses* (Paris, 1702), and P. L. L. de Vallemont, *La physique occulte; ou, Traité de la bague divinatoire* (ib., 1752).

**DIVISCH**, dē'vish, Procopius (1696-1765). An Austrian scientist, born in Senftenberg. He entered the Præmonstrant Order and became pastor at Brendiz. In 1754—and thus two years after Franklin's kite experiment—he erected in an open field the first lightning conductor on the Continent. The apparatus was destroyed by the peasants, who attributed to it the drought of the succeeding summer. Consult Friesz, *Prokop Dvish* (Olmutz, 1884).

**DIVISIBILITY** (from Lat. *divisibilis*, divisible; from *dividere*, to divide). That property of quantity, matter, or extension, through which it is either actually or potentially separable into parts. Whether matter is or is not indefinitely divisible is a question which has occupied the minds of philosophers since very early times. The diffusion of odors through the air for long periods from odoriferous bodies

without their suffering any sensible change of weight, and the tingeing of great quantities of fluid by very minute portions of coloring matter, are cases commonly appealed to in proof of the great divisibility of substances. Abstractly speaking, matter must certainly be conceived as divisible without limit; for the progressive subdivision of matter is nothing but division of the space occupied by it, and the infinite divisibility of space has been demonstrated geometrically by Descartes. However, this abstract Cartesian demonstration does not prove that there is no limit to the subdivision of matter by processes actually taking place in nature. The atomic hypothesis, disregarding the philosophical question as to whether atoms *could not possibly* be broken into fractions, assumes that they *are not* broken up in any physical or chemical process whatever. The phenomena of radioactivity have shown that larger atoms (such as that of radium) may be broken up into smaller ones (like that of helium), so that the original assumption of the atomic theory requires modification. If it is true, as J. J. Thomson has suggested, that the atoms of matter are really complex systems made up of the atoms of electricity, then the last products of the division of matter ought to be atoms of electricity. And if these may still be regarded as material particles, then the further question might be asked: Are electric atoms divisible? But—at least in the present state of human knowledge—such questions are really nothing but idle speculation, devoid of genuine scientific interest. See GASES, GENERAL PROPERTIES OF; MATTER; MOLECULES—MOLECULAR WEIGHTS.

**DIVISIBILITY (IN MATHEMATICS).** See DIVISION.

**DIVISION (OF. *division*, *division*, Fr. *division*, from Lat. *divisio*, from *dividere*, to divide).** In logic, the process of distributing all the objects included in the denotation (q.v.) of a concept (q.v.) into mutually exclusive classes, each of which is marked off from the others by the possession of some distinctive attribute. Logical division must not be confounded with physical division. In the former the term denoting the whole (called genus) can be predicated of the resultant parts (called species, see PREDICABLES); in the latter such predication is not possible. Thus, when Cuvier divided his order of primates (q.v.) into homo, simia, lemur, and vespertilio, he performed a logical division because the term "primate" is predicable of every one of the parts obtained; e.g., it can be said that *man is a primate*. But when a man is dissected into head, trunk, feet, etc., the division is not logical, but physical, because the term denoting the whole cannot be predicated of the parts; we cannot say that *the head is a man*. Traditional logic generally gives the following rules for correct division: First, the division must be exhaustive; i.e., the sum of the denotations of the species must be exactly equal to the denotation of the genus. Second, the division must be exclusive; i.e., no object found in the denotation of any species must be found in the denotation of any other species. Third, in order to secure conformity to the above rules, the division should be based on some one characteristic in regard to which the various objects in the denotation of the concept to be divided differ from each other. This characteristic used as the basis of division is

called the *fundamentum divisionis*. Thus, when plane triangles are divided into scalene, isosceles, and equilateral triangles, the *fundamentum divisionis* is the relative length of the sides of triangles.

**DIVISION.** In mathematics, one of the four fundamental processes of arithmetic, the one by which we find one of two factors when the product and the other factor are given. The given factor is called the *divisor*, the given product is called the *dividend*, and the result (i.e., the required factor) is called the *quotient*. The definition of division leads to the following identity: dividend = divisor  $\times$  quotient + remainder. If the remainder is zero, the division is said to be exact. The common symbols for division are:  $\frac{a}{b}$ ,  $a \div b$ ;  $a : b$ ,  $a/b$ ,  $ab^{-1}$ , in which

$a$  is the dividend and  $b$  the divisor. Two forms of division are recognized in elementary arithmetic, the one based on the idea of measurement and the other on the idea of partition. The former is the case of dividing one number by another of the same kind, and the latter that of dividing a concrete by an abstract number. Strictly speaking, however, all number is essentially abstract, so that the mathematical process is the same in any case. That is, the numerical work involved in  $\$8 \div 2$  is the same as that involved in  $\$8 \div \$2$ , viz., that involved in  $8 \div 2$ .

The usual tests of the correctness of division are: (a) multiply the quotient by the divisor and add the remainder, the result equaling the dividend; (b) compare the excesses of nines in the identity of division. See CHECKING.

Simple tests of the divisibility of numbers by 2, 4, 5, 6, 8, 9, 10, 11, are: (a) a number is divisible by 2, 4, or 8, if the number represented by the last digit, the last two digits, or the last three digits is divisible by 2, 4, or 8, respectively; (b) a number is divisible by 5 if it ends in 0 or 5, by 10 if it ends in 0; (c) a number is divisible by 9 or by 3 if the sum of its digits is divisible by 9 or 3 respectively, and it is divisible by 6 if it is even and the sum of its digits is divisible by 3; (d) a number is divisible by 11 if the difference between the sum of the digits in the odd and in the even places is divisible by 11. The simplest test of the divisibility by algebraic binomials is that of the remainder theorem (q.v.). The division of large numbers is generally facilitated by the use of logarithms (q.v.). For the origin of the present method of division and for improved forms, see ARITHMETIC.

**DIVISION.** In military organization, a body of troops, consisting usually of two or more infantry or cavalry brigades, to which are attached a proportion of auxiliary and special troops of the other arms. The term is sometimes used as a classifying title, as "the cavalry division," "infantry division," etc. The strength and composition of a division vary in times of peace according as alterations are made in tactical or organization dispositions and in time of war according to the needs of the work for which the division is formed. In the United States army a division in time of war consists normally of three brigades of infantry, one brigade of artillery, a regiment of cavalry, and the necessary engineer, signal, sanitary troops, and transportation. The *division* is the great administrative and tactical unit and forms the basis of army organization. In round numbers a division has about 20,000 men, 8000 animals, and 700 wagons.

When two or more divisions are combined to form a *field army*, an *auxiliary division*, made up of all arms, . . . heavy guns, may be attached to the . . . A division is the appropriate command of a major general. In Germany an infantry division consists of two brigades, to which, under the command of the general commanding, are attached four squadrons of cavalry, four batteries of artillery, each of six guns, and a battalion of riflemen, or, in some instances, pioneers. In some of the continental armies the *corps d'armée* corresponds in completeness to the United States field army, composed of two or more divisions. See ARMY ORGANIZATION.

In naval usage a division is a group of ships constituting a part of a fleet, or one of the parts into which the crew of a man-of-war is divided. See SHIP'S COMPANY.

**DIVISION OF LABOR.** In political economy, an expression designating, somewhat awkwardly, the fact that in modern production each workman performs a part only of the process of manufacture. His work is coordinated with that of others to complete the whole. The fact of division is dependent on the fact of coöperation, which is the essential feature. Foreign economists have deemed it wise to use the more general term "coöperation," but in English economics the term "division of labor" has become consecrated through the labors of Adam Smith, and it would be idle at this late day to substitute the more exact formulation. Adam Smith drew attention to the increased productiveness which results when, in the process of manufacture, the several operations are apportioned to different workmen, so that each workman shall perform continually one operation instead of performing several in succession. This is the narrowest view of the division of labor, and subsequent writers have extended the term so that it includes not only the separation of processes in one employment, but also the separation of employments. The fact that one man is exclusively a carpenter and another exclusively a smith enhances their combined production over what it would be if each were a jack-of-all-trades. Other writers have still further extended the notion and speak of a national division of labor, by which they would designate the peculiar aptitudes of certain nations for certain branches of production, and which under a system of unrestricted commerce would probably promote a contrast between the economic activities of the several parts of the world. The division of labor has become one of the commonplaces of modern industry, and we do not perhaps sufficiently realize how entirely the effectiveness of modern production rests upon it. It may be well to review briefly the advantages of the division of labor set forth with so much skill by Adam Smith, which subsequent experience has so amply verified. In the first place, it promotes in a high degree the skill of the laborer. By devoting his energies solely to one operation, he acquires in it a dexterity which could not have been obtained if his attention had been given to many things. The hand that daily performs the same task comes to do it almost automatically. With the better separation of labor it is possible to employ persons according to their capacities. While some operations require great strength, others demand nicety of touch and extreme delicacy of handling. The weak, who find no place in the

runder labors of agriculture or mining, find in manufacturing a place for their labor. Without discussing at this point whether the increase of the labor of women and of young persons has been a social benefit, we can readily see that the division of labor which has made it possible has increased the national production by practically increasing the number of laborers and diminishing the relative number of dependent persons. Another advantage of division of labor lies in the saving of labor and of time. The skilled workmen make better use of the materials intrusted to them than do those who are not trained, and thus prevent waste; while the continuity of employment practically increases working hours by saving the time which would otherwise be spent in passing from one employment to another. To realize what this means, one has only to compare the labors of the agricultural population, where division of labor is not practicable to the same extent as in other forms of production, with those of the artisan classes. Not the least advantage resulting from the division of labor is the stimulus which is given to invention by the concentration of energies upon distinct and definite processes. While it may be true that learned men have made some of the most noted inventions of our time, it is equally true that the many thousands of modifications of tools and machines which have made them feasible and workable have come largely from those who have been in daily contact with their operation.

The discussion which has been given here has been in view of the separation of employment in the operations of a workshop or a factory, but it must be equally obvious that like gains result from the differentiation of functions among the people generally from the increase of specialism, not only in trade and commerce, but also in professional and scientific activities. Nor need space be given to the demonstration of the fact that the division of labor between localities and between nations creates in each special aptitudes which might not otherwise be awakened, and thus increases the sum of gratifications which are in the reach of mankind at large. To offset these advantages, which are almost self-evident, there have been urged against the division of labor disadvantages of considerable weight. It has been contended that the production of a workman whose only knowledge was how to polish the point of a pin was a pitiable spectacle for which modern industry was responsible. Not only is it urged that such extreme specialization is deleterious to the intelligence and that it saps the vitality, but it has been pertinently pointed out that in the revolutions to which industry is subject such a man might find himself without a place and without a living. When the facts are as stated, there can be no question of the hardship caused the individual. But the case is probably extreme. While it is true that well-rounded workmen are less frequent to-day than formerly, it is also true that the mechanical operations of factories are not so widely dissimilar that one who is displaced from one type of factory might not find suitable employment in another, with somewhat similar operations, but with somewhat different materials. Nor should it be forgotten that in comparisons between the workman of to-day and the man of yesterday it is not infrequent that the average man of to-day is compared with the skilled man of yesterday, and that



while years ago there were many skilled carpenters, there were also many who were quite unskilled, and the man who at the present time performs a single operation in a planing mill has perhaps deteriorated from the skilled and efficient craftsman who was his predecessor, but has risen, on the other hand, from one who bungled at the trade because he had not the aptitude to acquire skillfully all of its processes, and was not permitted under the older organization to devote himself to that one in which he would have been most efficient. It is further pointed out that with the subdivision of industry and the increasing use of machines there is opportunity through the reduction of working hours for mental development outside, even if the mental stimulus which comes from the work itself is not so great as formerly. In short, the disadvantages of the division of labor which were set forth with so much apprehension by writers of 50 years ago have not in the development of things proved so serious in their effects upon the working classes as they appeared. There can be little doubt that during the century just ended the progress of the working classes, not only in their material welfare, but in their intellectual development, has been greater than in any preceding period of the world's history. See **POLITICAL ECONOMY; PRODUCTION.**

**DIVITIACUS**, or **DIVITIACUS**. A Druid and chieftain of the *Ædui* (q.v.). His tribe enjoyed a friendly alliance with the Roman government, and Divitiacus himself visited Rome, where Cicero conversed with him on the subject of Druidism (*De Divinatione*, i, 90). When Cæsar, in 58 B.C., refused to allow the *Helvetii* (q.v.) to migrate from their lands in Switzerland and settle in Gaul, he relied on the *Æduans* and Divitiacus to furnish supplies for his army; but Dumnorix, a brother of Divitiacus and a bitter enemy of Cæsar, had, according to Cæsar, by bribery and intimidation secured the chief power among his people, and the supplies were withheld. Cæsar learned the facts, suppressed Dumnorix, restored Divitiacus to power, and, with supplies thus assured, crushed the horde of *Helvetii* near the town of Bibracte (Cæsar, *B. G.*, i, 16 et seq.). Divitiacus remained a faithful ally of Cæsar during his further campaigns.

**DIVONA**. See **CAHORS**.

**DIVORCE** (Lat. *divortium*, from *divertere*, to go apart). Divorce, in modern law, is a dissolution of marriage, by public authority, at the instance of one of the parties, for a cause that has arisen since the establishment of the connubial relation. Divorces are sometimes granted by the legislature, but usually by the courts under general laws. A judicial declaration that two persons who have gone through the form of contracting marriage are not husband and wife (as in the case where one of the parties was already married) is not a divorce; nor is the term "divorce" properly applied to an annulment of marriage for a cause that antedates the marriage (e.g., impotence or fraud). Again, a judicial separation which merely relieves the parties of some of the duties and suspends some of the rights connected with the connubial relation is not a divorce, for divorce dissolves the connubial bond itself.

**History of Divorce.** In early society the husband usually had the right of repudiating his wife, originally, perhaps, at pleasure, among some races only for cause. Primitive causes

were witchcraft, drunkenness, barrenness, adultery. In those communities in which the man became a member of his wife's family, power to repudiate him was usually accorded to her or to her kinsfolk, as was the case among some tribes of North American Indians. Among the Athenians the husband could dismiss his wife at pleasure, and the wife could leave the husband with the consent of the magistrate (*archon*). In ancient Rome the rules governing divorce depended upon the form of marriage. If the parties had entered into a religious marriage (*confarreatio*), divorce was possible only by another religious ceremony (*diffarreatio*), which, like the marriage, required the coöperation of the priests. If the marriage was in form a purchase (*coemptio*), the wife could be reconveyed into her original family only for grave misconduct. If, however, the marriage was "consensual"—and this type of marriage became general in the later Republic—it was dissoluble by dissent; i.e., either party could repudiate the other. To the Romans of the early Empire this freedom of divorce seemed morally right; and as late as the third century of our era the Roman jurists held that a promise not to exercise the right of divorce under any circumstances was an immoral promise. Even when the Empire became Christian, the right of divorce at will was not abolished; all that was done was to impose pecuniary disadvantages upon the party who exercised the right of divorce without good cause, or upon the party whose misconduct gave good cause for divorce. In the view of the Christian Church, however, marriage was a sacrament, and the matrimonial relation indissoluble; and in the Middle Ages, when the Church courts obtained jurisdiction over marriage, this view determined the law of Europe. Marriages might be declared null because of impediments which existed at the time of marriage, but marriages could not be dissolved because of any subsequent misfortune or misconduct. This is still the law in some of the European states, e.g., in Italy, Spain, and Portugal, and in Austria so far as members of the Roman Catholic church are concerned. Divorce reappeared with the Reformation and was part of the programme of the French Revolution; and in the great majority of the European states (and in Austria, as regards non-Catholics) divorces can be obtained at the present time on various grounds—always for adultery and for extreme cruelty, usually for desertion, and in some states on the ground of conviction of an infamous crime and of incurable insanity. Incompatibility, strained relations, unconquerable aversion, etc., are grounds usually for separation only; but in some states a separation obtained on such grounds may, after a term of years, be converted into an absolute divorce. Divorce by mutual consent was permitted by the Code Napoléon, and also, when the marriage was childless, by the Prussian Code of 1794; but divorce on this ground is not permitted by the existing legislation of France nor by the German Imperial Code. In the former country the subject is now regulated by legislative act of 1883. The idea that marriage is something more than a private relation, that it is the basis of the existing social order, and that society is interested in its maintenance, finds expression in it, not only in the rule that divorce is to be granted only for cause, but in the practice of making the official who corresponds to the American district at-



torney a party to every proceeding for divorce or annulment of marriage.

In England there was no common-law jurisdiction in matrimonial causes prior to the creation of a divorce and matrimonial court by Act of Parliament in 1857, and the ecclesiastical courts, to which that jurisdiction had been confided, consistently held the marriage tie to be indissoluble. Accordingly, before Jan. 1, 1858, when the Matrimonial Causes Act (20 and 21 Vict., c. 85) went into operation, divorces could be obtained in England (as is still the case in Ireland) only by act of Parliament. It was, indeed, possible to obtain a declaration of nullity of marriage on the ground of consanguinity, previous marriage of one of the parties, mental or physical incapacity, coercion, or fraudulent representations as to the essentials of the relation, as, e.g., false personation. But the judgment so obtained was not a decree of divorce, but a declaration that the marriage tie between the parties had never really been contracted. A wife may now obtain a divorce on the ground of the husband's incestuous adultery, or of his bigamy with adultery, or of rape, or of sodomy, or of adultery coupled with gross cruelty, or of adultery coupled with desertion without reasonable excuse for two years. The husband may obtain a divorce on the ground of the wife's adultery without other cause. But neither party can obtain a divorce on the ground of desertion alone, however long continued. Nor will a divorce be granted should it appear that husband or wife has been guilty of recrimination by committing the same offense, or that there is collusion between them in order to procure the divorce. Parties also who have condoned the offense—i.e., who after it has been discovered have consented again to live together as husband and wife—will not be allowed to obtain a divorce. In order to guard against fraud by parties contriving to procure a divorce, power is given to the Queen's proctor, by 23 and 24 Vict., c. 144, to interpose, in case he have reasonable ground to suspect collusion or recrimination, in order to oppose a petition for divorce. The court may order the husband to pay a divorced wife a certain sum for her maintenance during their joint lives. After decree of divorce the offending party may marry again, even with the paramour. But it is enacted, 20 and 21 Vict., c. 85, that no clergyman shall be compelled to solemnize the marriage of any person who has been divorced. By the acts of 1857 and succeeding years parties are also entitled to obtain a judicial separation on the ground of adultery, cruelty, or desertion. Judicial separation is declared to be in place of a *separation a mensa et thoro*. A married woman, having obtained a decree of judicial separation, is declared to be in all respects as a *feme sole* in regard to any property that she has or may acquire. Even before obtaining a separation a woman deserted by her husband may obtain from the court a protection for any property she may acquire by her own industry.

In the United States, during the Colonial period, the legislative bodies in the several provinces gradually assumed the power of granting divorce, and after the Revolution the system of divorce by legislative enactment became uniformly established. Experience of this system proving its defective character, the jurisdiction over divorce cases was generally transferred to the courts of equity, and in many of the State

constitutions it was expressly provided that divorce by legislative act should not be permitted. There is no national control over divorce in this country, and, as the States make their own laws regulating the dissolution of marriage, the greatest diversity in their treatment of the subject has arisen, some of them refusing divorce altogether, or granting it only for a single cause, and others going to the extreme of freedom in permitting the dissolution of the marriage bond.

This want of uniformity makes it impossible to lay down general principles as to the grounds on which divorce is granted in the United States as a whole, and a brief outline of the laws relating to the subject in the different States is all that can here be attempted. There are laws granting divorce on certain specified grounds in all the Commonwealths and Territories except South Carolina. In the latter State divorce is not granted on any grounds whatever, either by the courts or by legislative act, and the results of this state of things offer an interesting subject for investigation to those who maintain the strict canonical view with regard to the indissoluble nature of marriage. It has been remarked that the prevalence and partial legal recognition of concubinage are the effects of this attitude towards the divorce question in South Carolina. (Bishop's *Marriage and Divorce*.) In all the other States infidelity and violation of the marriage vow are recognized as valid grounds for divorce. In New York adultery alone warrants absolute divorce in the eye of the law. Willful desertion is generally considered a sufficient cause, but the period of absence necessary to substantiate the complaint varies in the different States from one to five years. Other grounds generally recognized are habitual drunkenness; conviction of felony; intolerable, extreme, or repeated cruelty; and continuous desertion. Among the various grounds less generally admitted are insanity, failure of the husband to provide for the wife; willful neglect for three years; absence without being heard from for three to seven years; separation for five years; ungovernable temper; cruel treatment, outrages, or excesses, such as render living together intolerable; notorious immorality of the husband before marriage, unknown to the wife; gross misbehavior or wickedness; gross neglect of duty; attempt on life; refusal of the wife to move into the State; three years with any religious sect that believes the marriage relation unlawful; joining such a sect and refusing to cohabit for six months.

Such are the various grounds on which the marriage tie may be dissolved in the United States; but condonation, or collusion, or connivance, with the purpose of procuring a divorce, is in all States regarded as a bar to the dissolution of marriage. In Georgia divorce is granted only after the same verdict has been reached by two juries at different terms of the court. In Connecticut, Illinois, Kentucky, and Missouri, the divorced parties may remarry without restriction. In Massachusetts either party may remarry, but the defendant must wait two years and get the permission of the court. In Virginia a decree of the court may restrain the guilty party from marrying again; and in Maine the parties cannot marry till after two years without the court's permission. In New York the plaintiff may remarry, but the defendant is not permitted to do so in the former's lifetime.

except by the express permission of the court, or if, after five years have passed, the plaintiff has remarried, and the defendant's conduct has been uniformly good during the interval. Violation of this rule is punished as bigamy, even when the other party has remarried. In Delaware, Pennsylvania, and Tennessee, the party divorced for infidelity to the marriage vow cannot marry the partner in guilt during the lifetime of the former spouse; nor in Louisiana at any time, such marriage in the latter State being considered bigamy.

From the conflict of laws in various countries on the subject of divorce, questions have frequently arisen as to the competency of a tribunal having power to annul a marriage contracted elsewhere. In the absence of personal service upon the defendant many States refuse to recognize such divorces, and much confusion results as to questions of bigamy, dower, children. In the case of *Estes v. Texas*, 201 United States Reports, 562, it was decided by the Supreme Court in 1906, four justices dissenting, that a divorce granted in a State where the defendant is not domiciled, without personal service of process or a voluntary appearance by the defendant, though valid in the State where decreed, need not be recognized by any other State. The courts will not recognize a transient visit to a foreign country as sufficient ground to sustain a divorce there granted. See CONFLICT OF LAWS; DOMICILE.

**Statistics.** Divorce, in its broader social aspects, can best be introduced by a summary of statistics drawn from various official sources. The best authorities are the report on *Marriage and Divorce* prepared by Carroll D. Wright, United States Commissioner of Labor, in 1889, and covers the period 1867-86, and the Report of

1071 in 1867, 2606 in 1886, and 5943 in 1906. Michigan divorces increased from 449 in 1867 to 1339 in 1886 and 3259 in 1906. Vermont had 157 in 1867, and, with a slight increase of population, had 301 in 1906. All these States have several statutory grounds of divorce. Changes in the statutes and in the administration of the various county courts in part account for conditions in Vermont and Connecticut and perhaps one or two other of these States.

New York, which grants divorce for adultery only, and New Jersey, which adds desertion (the most easily abused of all causes, unless it be the former "omnibus clause" of Connecticut and a few other States), are instructive examples of another kind. New York granted 771 in 1867 and 1006 in 1886, an increase of less than half the increase of population. In 1906 New York granted 2069 divorces, an increase of 100 per cent in divorces in a period in which population increased 50 per cent. New Jersey, with its additional and easily misused cause of desertion, granted 60 in 1867, 286 in 1886, 292 in 1893, and 530 in 1906. New York, with one cause, and that one difficult of proof, grants more divorces in proportion to population or to marriages than New Jersey, though the latter adds desertion. The explanation is chiefly in the difference of administration. In New York divorces are granted in each county and city, while in New Jersey divorce cases go to one court—the highest in the State—whose chancellors require written testimony and sift it with great care.

In the West high divorce rates prevail, but no higher than some already given. The increase of population there is so great that figures are misleading, unless compared with population. The growth of divorce in the South is indicated by the following table:

STATE	Divorces 1867	Population 1867 U. S. est.	Divorces per M. pop.	Divorces 1886	Population 1886 U. S. est.	Divorces per M. pop.	Divorces 1906	Population 1906 U. S. est.	Divorces per M. pop.
Alabama. . . .	78	987,154	0.08	662	1,413,045	.47	2,162	2,014,337	1.07
Arkansas . . .	121	469,764	0.26	646	997,939	.65	2,428	1,469,298	1.66
Kentucky. . .	292	1,271,415	0.23	757	1,774,660	.43	2,050	2,232,812	0.92
Mississippi. .	49	816,939	0.06	504	1,226,397	.41	1,930	1,698,774	1.14
N. Carolina. .	21	1,047,740	0.02	163	1,530,670	.11	380	2,081,298	0.18
Tennessee. . .	287	1,213,905	0.24	801	1,677,455	.48	2,172	2,119,118	1.03
Texas . . . .	91	754,267	0.12	1,326	1,978,017	.67	5,172	3,557,408	1.46
Virginia . . . .	90	1,182,017	0.08	238	1,598,617	.15	1,074	1,978,642	0.54

the United States Census Bureau on Marriage and Divorce, published in 1908, which covers the period 1887-1906. The annual reports of eight or nine States only, and of various European countries, give figures for later years.

In the 20 years 1867-86 there were found to have been 328,716 divorces in the United States whose libels or records were discovered. The number of divorces in the period 1887-1906 was 945,625. The figures of a few typical States may be cited: Connecticut granted 500 in 1867 and 557 in 1906, being one of the two or three States where divorces increase more slowly than the population. New Hampshire granted 136 in 1867 and 473 in 1906. Ohio granted 901 in 1867 and 4781 in 1906. Indiana had 1096 in 1867, the largest number for that year in any State, and 1655 in 1886. But in 1900 there were 4699, and, in 1906, 4048. Pennsylvania granted 575 in 1867, 1889 in 1886, and 3027 in 1906. Illinois granted

In the South as a whole the movement was slow in the first part of the period, but was greatly accelerated later. Technically 16.3 per cent of all the divorces in the United States in the period 1887-1906 were granted for adultery, 38.9 per cent for desertion, 21.8 per cent for cruelty, 3.9 per cent for drunkenness, and so on. But these figures are of little value as indications of the real causes. The wife is the applicant in about two-thirds of the cases—often, it should be noted, as a personal convenience to the parties. In the period 1887-1906 approximately three-fourths of the applications for divorce were granted. In a little over two-thirds of the cases the libelee was a resident of the State in which the divorce was granted; in 12.6 per cent of the cases the residence of the libelee was unknown. This shows that migratory divorces, though many in number, are only a small part of the entire number granted in the country. The abuse of

our conflicting laws and the uncertainty to which they expose our people are very serious. But the real gravity of the situation is in the almost universal prevalence of divorce in all parts of the country, both in city and rural communities, though generally somewhat less in the latter than in the former.

Apparently more divorces in this country occur in families where there are very few or no children and at the other extreme, where children are very numerous. The latter fact is due probably to the desertion by fathers of large families among the lower classes. One or two States have attempted to check this by statutes making culpable neglect to support one's family a misdemeanor.

European figures are also instructive. Divorces or separations—the latter chiefly in Catholic countries—are as follows: Austria granted 883 in 1891 and 2309 in 1906; Belgium 130 in 1867 and 618 in 1906; France, 2181 in 1867 and 2806 in 1882. In 1885, the first full year under the Law of 1884, there were 6245, 7460 in 1897, 8431 in 1902, and 7019 in 1906. England and Wales granted 130 in 1867 and 670 in 1906; Scotland, 32 in 1867 and 169 in 1906. The German Empire granted 3942 in 1881, 12,180 in 1906; Prussia granted 2329 in 1881, 5699 annually during the period 1895–99, and 7539 in 1906; Bavaria granted 270 in 1867 and 746 in 1906; Saxony, 396 in 1867, 935 in 1893, and 1470 in 1906. In Italy the movement fluctuated a good deal from year to year. In 1891 there were 591 legal separations, in 1904, 859. In the Netherlands there were 133 divorces in 1867 and 995 in 1906. Norway granted 33 in 1870 and 366 in 1906. Sweden granted 128 in 1867 and 448 in 1905. Rumania granted 276 in 1871 and 1800 in 1904. Switzerland, in six cantons, granted 190 in 1867 and 287 in 1875. The next year, under the uniform federal law, the same cantons granted 444, and 396 in 1886. In the entire country, under a uniform law, there were 1102 in 1876; 1036 for each of the two following years; there were less than 900 on the average until 1896, when they rose to 1058, being 1053 in 1900. The ratio to marriage is generally about 1 to 22, being the highest of any country in Europe and about the same as in Massachusetts.

Divorces in Canada are very few, there being only 19 in 1904. Of these, 8 were granted in Nova Scotia and New Brunswick, where the courts and not the legislative bodies have jurisdiction of the subject. In Australia there were 140 divorces in 1890, 340 in 1896, and 339 in 1905. New Zealand granted 16 in 1884, 25 in 1893, and 152 in 1906. In Japan the divorces for several years are about one-third the marriages. Until recently public law there exercised no control over marriage and divorce, these being left to the families immediately concerned. As a rule, the divorce rate in the United States is several times greater than in Europe. There are courts of divorce in all of the nearly 3000 counties in the United States, except in South Carolina and New Jersey. A single divorce court exists in England; one in each of the 28 judicial districts of Germany, while there is one in each of the 79 departments of France. The presence of several statutory grounds for divorce and their phraseology, rather than the technical number of causes, and the practice of the courts in regard to their interpretation, affect the number

granted. The prevailing local sentiment may perhaps be considered a still more influential factor in determining the number.

The strong legislative movement for greater freedom of divorce of the past century has been succeeded in many jurisdictions by a somewhat reactionary tendency. This appears in the removal of the "omnibus clause"—that giving general discretion to the courts to act beyond the definitive statutes—from the statutes of Connecticut and other States; in the raising of the period of residence from three to six months to one or more years in several States and all the Territories; in requiring a period of six months or more to intervene between the granting of the decree and its final issue to the parties; and in striking out all grounds for divorce in the District of Columbia except one. The Imperial law of 1900 in Germany reduces the causes to about four. It prevents the abuse of the plea of desertion by requiring, before a decree is granted, a preliminary suit for the restitution of conjugal rights and allows a year for the accomplishment of this object. Improved marriage laws have also helped in the matter of divorce.

**Uniform Laws.** The problem of uniformity took on a new aspect on the appearance of the government report of 1889 and the discussion that preceded and followed. The value of national legislation, under constitutional amendment, in restricting the number of divorces, it was then seen, might be very small. The obstacles in the way of getting three-fourths of the States to consent to it, and of enforcing it in localities where public sentiment would be hostile, appeared very great. Then the transfer of the care of marriage and divorce to the Federal authorities or to State regulation under Federal provision, with its effect on laws of inheritance and the like, and upon our present system of division of powers between the Federal and State . . . opens many serious and difficult . . . . Consequently most thoughtful students of the problem have felt that the present experiment, in which thirty-four States and Territories are already represented, of trying to secure uniformity by enacting the bills their commissioners on uniformity prepare and recommend, should have fair trial as the better way at present of either gaining all that can be accomplished or of preparing for the constitutional amendment itself, should that be found necessary.

**The Social Movement.** It is evident that there is a profound and widespread social movement going on beneath the great variety of law, religion, and other conditions through which this movement finds expression, and which is most marked in the United States. Until recent years, and even now, divorce is treated chiefly in its legal or ecclesiastical phases. This treatment has also been individualistic to a degree. That is, both church and state have regarded chiefly the two individuals directly concerned, with some consideration of the interests of the church or state. But the family has been almost entirely overlooked. The canon law, the writings of the early fathers, and, in fact, the great body of literature on the subject, are singularly lacking in direct attention to the family as the real subject in the discussion of divorce. The term "marriage" has been used to cover both the formation of the marriage and the subsequent relation. Two

views of the relation and its dissolution grow out of this. One tends to make the relation a mere contract from beginning to end and therefore subject to be dissolved, like any other contract, at the will of the parties. The other insists that a *status* is created by the original contract, and that it is this *status* or relation with which divorce deals. This is indeed the legal view of the relation. But rarely is attention called to the fact that the *status* arising from the contract of marriage is not merely a relation of the two contracting parties, as in a partnership, e.g., but a family relation, thus in reality making divorce the legal dissolution of a family instead of individual relief from a contract or a personal status.

The Roman Catholic church has held to a consistent course in its ecclesiastical discipline, but has generally been compelled to share its control of divorce in recent times, in the more progressive countries with the state. In Russia the Orthodox Greek church and other confessions are allowed to administer, in all affairs of marriage and divorce, according to their own rules. Austrian law also adjusts itself to the different faiths of its subjects. And divorce laws, in their grounds for divorce, usually follow the religious opinions of the people.

The condition of what may be called the social strata of a period or country helps to shape the customs or laws of marriage and divorce. Among the early peoples of the Mediterranean these subjects were entirely within the control of the families immediately concerned, as in Japan until recently. The three kinds of Roman marriage were the expression of as many types in Roman society. As the early family yields more and more of social function to the state, the individual and relations of contract gradually supplant the family and those of *status*. All intermediary social forms, especially those of the domestic and communal type, tend to shrivel and lose their functions. Historically the increase and prominence of divorce have marked decaying civilizations. Whether the increase of the last 30 years will continue in the United States remains to be seen. There is an element of truth in the claim that the increase of divorce is in one sense the incident of social health. This rests, however, on certain assumptions concerning those who seek divorce which are of limited application.

Christianity came when the Roman world was far along in social disintegration. Early Christianity necessarily sought men as individuals and dealt with them as such. Marriage, divorce, celibacy, chastity, were all considered chiefly with regard to their effect on individual well-being. Their social, institutional bearings were ignored, unless it was in respect to the Church. The family is hardly named in the canon law, which was cast in the matrix of Roman law when in its later stages of individualism, in the regulations of Protestant churches. The emphasis of the Reformation on the individual, the art of printing, the use of gunpowder, the beginnings of modern science, and the discovery of America, all increased the power of the individual. Later, the ethical and political theories of Grotius, Hobbes, Locke, Rousseau, Blackstone, and Jefferson, the earlier schools of political economy, the American and French revolutions, the rise of the modern industrial system, and still later the use of steam and electricity, have all done much to accelerate

those changes by which the individual and the largest social combinations have absorbed the attention of society at the expense of all domestic and commercial groups. The evangelistic work of the last century, the temperance and the anti-slavery reforms, and the advancement of woman through assertion of her rights, should also, for similar reasons, be named as directly or indirectly contributory to the increase of divorce. That the general result is good as a whole may be fully conceded without denying the incidental evils. The increase of divorce and changing opinions and practice regarding marriage and other incidents of the family in this light seem to be the result of changes in the constitution of Western civilization. How far the disintegration and reconstruction of families is consistent with the health and growth of the social body has become a question of first importance in social science.

**Change of Treatment.** The growth of social science, especially in the form of sociology taken in relation to the social sciences, much as biology is related to its kindred sciences, is gradually but surely changing the discussion of divorce. For from this point of approach it is soon perceived that the family is the real object of study, and that marriage and divorce, as well as other of its incidents, are acts formative or destructive of the family. This puts the subject on a new ground. Historical sociology reveals the place of the family, and with it that of property, a subject always wrapped up with that of the family in early society, and in the development of civilization in all its more important phases. The scientific analysis of the present social order shows how the monogamous family embodied in the home has become to the social structure what the cell is to the human body. For the question of divorce compels us to ask: "What is marriage? What is the family? How far does the family, in its structure and principles, enter into the national constitution of a people? Can we hold to theories of the family which we have repudiated in our treatment of the state? Are the family and church and state of the same nature? Can democracy be allowed to go to the extreme of individualism, and end in the dissolution of the state and the family by mutual consent?" Most of the discussions of former years in religious circles in this country, and even now, have not got much beyond the old method of the treatment of divorce as the chief concern of two individuals, through the application of the precepts of individual morality. The different religious bodies have busied themselves with their respective tenets, increasing the number of justifiable grounds for divorce and the practice allowable under them, many assuming that the Founder of Christianity legislated on the subject for His Church, or perhaps, for both church and state. These things are being reiterated with much vehemence in many quarters. They strengthen many in the old faith and probably convert some others to it.

But the scientific study of society which has come about and rapidly spread in our higher educational institutions within the last 25 years, and the modern methods of biblical interpretation, have combined to force considerable change already. In some quarters at least the method of threshing over the old ground with grammar and lexicon, with the addition of mere archaeological information, is giving way, and attention

is turning to the underlying social factors in the problem. The chapters on "The Family," in Prof. Shailer Matthews's *Social Teaching of Jesus*, and in Prof. Francis G. Peabody's *Jesus Christ and the Social Question*, with some recent books on social ethics, may be cited in evidence of a change that is going on in the method of treatment by which the family has come to the front, both in scientific and religious circles, and marriage and divorce made its incidents rather than treated as separate subjects. It is too early to predict definite results, though the movement is one of much promise.

The chief recent periods of discussion are as follows: In England, over the Divorce Law, by Mr. Gladstone and others in 1857; in Connecticut, in 1866-69, when President Woolsey, of Yale, and Professor Hovey, of Newton Theological Seminary, published small volumes on the subject; in Switzerland, in 1875, when a federal law was enacted; in France, over the Law of 1884, by M. Bertillon, M. Naquet, and others; in New South Wales, over the Law of 1892, by Sir Alfred Stephen; in Japan, about the same time, when divorce first came under the control of the state; and in Germany, when an Imperial law went into effect, Jan. 1, 1900. The discussion in the United States was renewed in 1878. The society now known as the National League for the Protection of the Family has had an important part in the discussion of this period.

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**DIVOT.** See FEAL.

**DIX, DOROTHEA LYNDE** (1802-87). An American philanthropist and writer of juvenile books, born at Worcester, Mass. She was noted for her interest in the unfortunate and criminal classes. During the Civil War she was superintendent of hospital-nurses. In the course of labors to improve the condition of paupers, lunatics, and prisoners she visited every State east of the

Rocky Mountains and procured ameliorative legislation in many of them. She published: *The Garland of Flora* (1829); *Prisons and Prison Discipline* (1845); and a great number of memorials on philanthropic subjects. Of many books for children, *Conversations about Common Things* and *Alice and Ruth* are typical. Consult F. Tiffany, *Life of Dorothea Lynde Dix* (Boston, 1890).

**DIX, JOHN ADAMS** (1798-1879). An American statesman and soldier, born at Boscawen, N. H. He entered the army as a cadet in 1812, served on the Canada frontier throughout the War of 1812, and in 1819 became the aid of General Brown, then commanding the Northern Department. In 1826 he was sent on a special mission to Denmark and in 1828 resigned his commission (of captain) to study and practice law in Cooperstown, N. Y. He soon became prominent in politics and was adjutant general of New York from 1830 to 1833 and Secretary of State and Superintendent of Common Schools from 1833 to 1840, besides being a prominent member of the "Albany Regency" (q.v.). He was chosen a member of the Assembly in 1842 and from 1845 to 1849 was a member of the United States Senate. In 1848, when the Democratic party divided on the question of the extension of slavery, he went with the Free-Soil wing, and was their candidate for governor, but was not elected. From January to March, 1861, he was Secretary of the Treasury under President Buchanan and as such endeavored to have all the revenue cutters in Southern harbors sent north before the beginning of hostilities. Among these two cutters from New Orleans were ordered to New York. The captain of one of them refused to obey the order, and Dix immediately telegraphed to have him arrested and treated as a mutineer if he offered any resistance, closing the dispatch with the words: "If any man attempts to haul down the American flag, shoot him on the spot." In 1861 Dix was appointed major general of United States volunteers and was placed in command of the Department of Maryland. In May, 1862, he was sent to Fortress Monroe and immediately after the New York draft riots (q.v.), in July, 1863, was sent to New York to command the Department of the East, which position he retained until July, 1865, when he returned to civil life. Subsequently he was Minister to France from 1866 to 1869 and from 1873 to 1875 was Governor of New York. Besides miscellaneous papers, he was the author of: *Resources of the City of New York* (1827); *Decisions of the Superintendents of Common Schools of New York, and Laws Relating to Common Schools* (1837); *A Winter in Madeira and a Summer in Spain and Florence* (1850); *Speeches and Occasional Addresses*, 2 vols. (1864). Consult Morgan Dix, *Memoirs of John A. Dix* (New York, 1883).

**DIX, JOHN ALDEN** (1860- ). An American Democratic politician, born at Glens Falls, N. Y. He graduated from Cornell University in 1883, and entering business became president of the Iroquois Paper Company, treasurer of the American Wood Board Company, vice president of the Blandy Paper Company, and manager of the Moose River Lumber Company; also vice president of the First National Bank of Albany. In 1904 he was a delegate to the Democratic National Convention, in 1908 Democratic nominee for lieutenant governor and chairman of the Washington County Democratic Committee, and

in 1910 chairman of the Democratic State (New York) Committee. From 1910 to 1912 he was Governor of New York.

**DIX, MORGAN** (1827-1908). An American Episcopalian clergyman, the son of Gen. John A. Dix. He was born in New York City and graduated at Columbia in 1848 and at the General Theological Seminary in 1852. Three years later he became assistant minister, and in 1862 rector, of Trinity Church, New York. He was, in a number of successive general conventions of the Episcopal church, elected without opposition as president of the House of Clerical and Lay Deputies, an honor which advancing age compelled him to decline in 1901. He published commentaries on Romans (1864) and Galatians and Colossians (1865); *Lectures on the Pantheistic Idea of an Impersonal Substance Deity* (1865); *Lectures on the Two Estates* (1872); *Memoirs of John A. Dix* (1883); *The Gospel and Philosophy* (1886); *The Sacramental System* (1893); *A History of the Parish of Trinity Church* (4 vols., 1898-1906).

**DIXEY, HENRY E.** (1859- ). An American comedian. He was born in Boston and at the age of nine years became a member there of the Howard Athenaeum Company, taking the part of Peanuts in *Under the Gaslight*. His subsequent experience included rôles in *Cinderella at School*, *The Mascot*, *Pinafore*, and a great variety of other plays. In 1883 he was engaged at the Bijou Theatre, New York, in *Adonis*, the character in which he made his greatest reputation. In 1894 he became a member of Daly's company for a season. Of his later performances, the most noteworthy is his creation of David Garrick in Stuart Robson's production of *Oliver Goldsmith* (1900). In 1911 he appeared with Mrs. Fiske as the Marquis of Steyne in *Becky Sharp* and as Peter Swallow in *Mrs. Bumpstead-Leigh*, and in 1914 played in Mackaye's *A Thousand Years Ago*.

**DIXIE.** 1. A Northern ballad of the Civil War, by T. M. Cooley. 2. A very popular ballad, by D. D. Emmett (1859), originating with Bryant's minstrels in New York and first performed at Mechanics' Hall. It was appropriated by the South and became one of the great Confederate battle songs of the Civil War. 3. A Confederate war ballad of the Civil War, by Albert Pike (1861), which first appeared in the *Natchez Courier*. See **DIXIE'S LAND**.

**DIXIE, LADY FLORENCE CAROLINE DOUGLAS** (1857-1905). An English explorer, writer, and champion of woman's rights. She was born in London, the daughter of the seventh Marquis of Queensberry, and married Sir Alexander Beaumont Churchill Dixie, Bart., in 1875. She spent some time in Patagonia in 1878-79 and described her travels in a volume entitled *Across Patagonia* (1880). She was a correspondent of the *Morning Post* of London during the Boer War of 1880-81 and was instrumental in the release of Cetewayo and his return to Africa. In her later life she became greatly interested in woman's rights. Among her writings are: *Defense of Zululand* (1882); *In the Land of Misfortune* (1882); *Gloriana* (1893); *Redeemed in Blood* (1890); *Eilabelle, or the Redeemed* (1904).

**DIXIE'S LAND, or DIXIE.** A term applied to the Southern States. Its derivation is obscure. It is said to have originated in New York, where a certain Dixie owned a large number of slaves. The latter, when obliged to mi-

grate to the South, grew to look upon their old home as a sort of paradise, which they celebrated in their songs. In time the term "Dixie's Land" was transferred to their new homes, and so became a name for the South among the whites as well as the negroes. The term is also popularly connected with Mason and Dixon's Line—the line of division between the free and the slave States—and is said to have been first used of Texas when that State joined the Union.

**DIX'ON.** A city and the county seat of Lee Co., Ill., 98 miles west of Chicago, on Rock River, and on the Chicago and Northwestern and the Illinois Central railroads (Map: Illinois, C 2). It is the seat of the Northern Illinois Normal School (private), the Rock River Military Academy, and the Rock River Chautauqua, and contains a fine courthouse and public library. It manufactures condensed milk, shoes, plows, wagons, wire cloth, furniture, Portland cement, etc. Dixon, settled in 1836, adopted the commission form of government in 1911. Pop., 1900, 7917; 1910, 7216.

**DIXON, AMZI CLARENCE** (1854- ). An American clergyman, born at Shelby, N. C. He graduated from Wake Forest College (N. C.) in 1875, studied at the Southern Baptist Theological Seminary, and, being ordained to the Baptist ministry in 1876, held until 1883 pastorates at Chapel Hill and Asheville, N. C. Thereafter he filled the pulpits of Immanuel Church, Baltimore (1883-90), the Hanson Place Church, Brooklyn (1890-96), the Ruggles Street Church, Boston (1896-1901), the Moody Church, Chicago (1906-11), and the Metropolitan Tabernacle, London (1911- ). His writings include: *Milk and Meat* (1893; new ed., 1913); *Heaven on Earth* (1896); *The Lights and Shadows of American Life* (1903); *The Christian Science Delusion* (1903); *Present-Day Life and Religion* (1905); *Evangelism, Old and New* (1905); *The Young Convert's Problems* (1906); *The Bright Side of Life and Other Sermons* (1914); *The Glories of the Cross and Other Addresses* (1914).

**DIXON, CHARLES** (1858- ). An English ornithologist, born in London. He discovered the St. Kilda wren and a new species in North Africa. He collaborated with Henry Seebohm on his great work on *British Birds*, in the second volume of which he summarized and modified A. R. Wallace's theory of the relation between nests and coloration of birds. Dixon made a special study of bird migration—especially in his book *The Migration of Birds* (new ed., 1897), an ingenious but overtheoretical work—and of geographical distribution of birds. Of his many books the following may be mentioned: *Rural Bird Life* (1880); *Evolution without Natural Selection* (1885); *Our Rarer Birds* (1888); *The Nests and Eggs of British Birds* (1893; illustrated, 1894); *British Sea Birds* (1896); *Lost and Vanishing Birds* (1898); *Game Birds and Wild Fowl of the British Islands* (1899); *Birds' Nests* (1902); *The Bird Life of London* (1909).

**DIXON, FRANK HAIGH** (1869- ). An American economist, born at Winona, Minn. He graduated in 1892 at the University of Michigan, where he remained until 1898, gaining his Ph.D. in 1895 and then teaching history and political economy. In 1898 he was appointed assistant professor, and in 1903 professor, of economics at Dartmouth College; and from 1900 to 1904 he served also as secretary of the Amos



Tuck School of Administration and Finance (Dartmouth). He was expert adviser to the Interstate Commerce Commission (1907-08) and to the National Waterways Commission (1909), and in 1910 became chief statistician to the Bureau of American Railway Economics. Besides contributing to magazines, he published: *State Railroad Control* (1896); *Recent Railroad Commission Legislation* (1905); *A Traffic History of the Mississippi River System* (1909).

**DIXON, JAMES MAIN** (1856- ). An American teacher and author, born at Paisley, Scotland. He graduated at St. Andrews University in 1879 and was appointed scholar and tutor of philosophy there in the same year. He was professor of English and secretary of the Imperial College of Engineering, Tokio, Japan, from 1879 to 1886, when he was called to the Imperial University of Japan in the same capacity. From 1892 to 1901 he was professor of English literature at Washington University, St. Louis, Mo. In 1903-04 he was president of Columbia College, Milton, Oregon. He was professor of English literature at the University of Southern California from 1905 to 1911, when he was transferred to the chair of Oriental studies and comparative literature. In 1906 he became literary editor of the *West Coast Magazine*. He compiled a *Dictionary of Idiomatic English Phrases* (1891) and wrote: *Twentieth Century Life of John Wesley* (1902); "Matthew Arnold," in *Modern Poets and Christian Teaching* (1906); *A Survey of Scottish Literature in the Nineteenth Century* (1907).

**DIXON, JOSEPH** (1799-1869). An American inventor. He made important improvements in photography, lithography, bank-note printing, steel smelting, and lens grinding. He was by turns a shoemaker, printer, lithographer, wood engraver, and physician, and gained wealth from his crucible works, established at Salem, Mass., in 1827 and removed to Jersey City in 1847.

**DIXON, JOSEPH MOORE** (1867- ). An American lawyer and public official, born at Snow Camp, N. C. He was educated at Earlham College (Ind.) and at Guilford College (N. C.). Admitted to the bar in 1892, he took up law practice at Missoula, Mont. He was assistant prosecuting attorney (1893-95), and prosecuting attorney (1895-97), of Missoula County, and a member of the Montana House of Representatives (1900). In 1903-07 he was a member of the United States House of Representatives, serving in 1904 as delegate to the Republican National Convention. From 1907 to 1913 he was United States Senator from Montana.

**DIXON, RICHARD WATSON** (1833-1900). An English poet, churchman, and historian, born in London, educated at Oxford, and ordained in 1858. He became honorary canon of Carlisle in 1874, vicar of Hayton, in Cumberland, in 1875, and vicar of Warkworth, in Northumberland, in 1883. His poetical works include: *Mano: A Poetical History in Four Books* (1883); *Odes and Eclogues* (1884); *Lyrical Poems* (1886); *The Story of Eudocia and her Brothers* (1888); *Songs and Odes* (1896); *Last Poems* (1905). His best title to fame, however, rests upon the *History of the Church of England from the Abolition of the Roman Jurisdiction* (6 vols., 1877-1900).

**DIXON, ROLAND BURRAGE** (1875- ). An American anthropologist, born at Worcester, Mass. In 1897 he graduated from Harvard University, where he remained as an assistant in

anthropology, taking the degree of Ph.D. in 1900, and then serving as instructor and after 1906 as assistant professor. He was vice president of the American Academy of Arts and Sciences in 1910-11 and president of the American Folk-Lore Society from 1907 to 1909. He is author of *Maidu Myths* (1902); *The Chimariko Indians and Language* (1910); *Maidu Texts* (1912).

**DIXON, THOMAS** (1864- ). An American novelist and playwright. He was born at Shelby, N. C., and graduated from Wake Forest College (North Carolina) in 1883. He served in the North Carolina militia during 1885-86, resigning to enter the Baptist ministry, but soon leaving the pulpit for the lecture platform and for the work of a novelist and dramatist. He wrote: *The Leopard's Spots* (1902); *The One Woman* (1903); *The Clansman* (1905); *The Life Worth Living* (1905); *The Traitor* (1907); *Comrades* (1909); *The Root of Evil* (1911); *The Sins of the Father* (1912); *The Southerner* (1913); *The Victim: A Romance of the Real Jefferson Davis* (1914). In the play, *The Sins of the Father*, which was produced in 1910-11, Dixon himself played the leading role.

**DIXON, WILLIAM HEPWORTH** (1821-79). An English writer and traveler. He was born in Manchester. Beginning life as a clerk, he decided in 1846 to take up literature as a profession, and, after gaining some journalistic experience at Cheltenham, settled in London. He became a contributor to the *Athenaeum* and the *Daily News*. In 1851 appeared his *Life of William Penn*. Two years later appeared his anonymous pamphlet, *The French in England*. From 1853 to 1869 he was editor of the *Athenaeum*. Among his other writings are: *The Personal History of Lord Bacon, from Unpublished Papers* (1861); *The Holy Lady* (1863); *New America* (1867); *Spiritual Wives* (1868); *Free Russia* (1870); *The Switzers* (1872); *History of Two Queens* (1873-74); *White Conquest* (1875); *British Cyprus* (1879).

**DIXON ENTRANCE.** A strait on the west coast of North America, separating Prince of Wales Island and others of the archipelago off the south arm of Alaska from Queen Charlotte Island on the south (Map: British Columbia, C 4). It is about 100 miles long, from east to west, and 70 miles wide, and connects the Pacific with Hecate Strait on the east. The line dividing the British possessions in this region from those of the United States passes through this strait near the southern end of Prince of Wales Island. See ALASKA.

**DIXWELL, JOHN** (1608-89). One of the three judges who condemned Charles I to death. He took an active part in the English Revolution as a colonel in the Parliamentary army and was a member of Parliament for several years. After the accession of Charles II he fled from England to save his life and, under the name of John Davids, lived, married, and died undiscovered in America, for the most part at New Haven, Conn. Consult Stiles, *History of Three of the Judges of Charles I: Whalley, Goffe, and Dismock* (Hartford, 1794).

**DIYALA, dē-yā'lā.** The most important affluent of the lower Tigris. The point of confluence of the two rivers lies between Bagdad and Ctesiphon. The Diyala takes its source within Persian territory in the Zagros Mountains, where it is known as the Gabe-Rud. South of parallel 35° N. it follows the Turco-



Persian boundary and is called the Shirwan. Once in Turkish territory the name of Diyala is given to it. Its waters have been diverted for irrigation since early historical times.

**DIZFUL**, dâz-fûl' (Pers., Dis Bridge). A town of Persia, the capital and principal mart of the province of Arabistan, situated on the river Dis, about 200 miles west of Ispahan (Map: Persia, C 6). The river is crossed by a handsome bridge of 22 arches, and the town contains 34 mosques, a number of schools, and baths. The chief article of commerce is indigo. Its pens, made of oak, are famous throughout the Orient. The population is estimated at 25,000.

**DJAKOVA**, jâ-kô'vâ. See ДЯКОВА.

**DJAMILÉH**, jâ-mê-lâ'. An opera by Bizet (q.v.), first produced at Paris, May 22, 1872; in the United States, Feb. 24, 1913 (Boston).

**DJEZZAR**, jêz'zâr (Ar. *jazzâr*, butcher, tyrant, from *jazara*, to slaughter) (c.1735-1804). A nickname denoting "butcher," given to Achmet Pasha, who was celebrated for his obstinate defense of Acre against Napoleon. He was born in Bosnia, of Christian parents, but turned Mussulman, entered the service of Ali Bey, with whom he occupied the position of chief assassin, and rose, through murder and treason, from the condition of a slave to the Pashalic of Acre. In 1799 he held Acre against Napoleon for two months and forced him to abandon the siege. Stories are extant of his fiendish cruelty, but they are probably exaggerations. As a ruler and man of affairs, he was exceedingly capable.

**DJINN**. See JINN.

**DJINNESTAN**, jîn'nê-stân', or **JINNES-TAN**. The mythical land of the Djinnns or Jinns (q.v.), the Oriental genii or fairies.

**DJOWE**, jowf. See JOWF.

**DLUGOSZ**, dlôŝ'gôsh, **JAN** (Lat. LONGINUS) (1415-80). A Polish historian, born at Brzez-nica and educated at the University of Cracow. As the protégé of Bishop Fbygniew of Cracow and of King Casimir of Poland, he was sent on important diplomatic missions to the Pope and also to Hungary, Bohemia, and several other countries. He conducted the education of the King's sons and instituted many pious and charitable endowments for university students. The publication that made him famous is the *Historia Polonica* (12 vols., 1455-80), which comprises a complete history of Poland to the date of publication and is characterized by a spirit of noble patriotism and by indefatigable research. His other works include a pretentious documentary history in 12 vols., written in the style of Livy, and considerable writing on ecclesiastical subjects.

**DNIEPER**, nê'pêr, *Russ. pron. dnyép'êr*. A river of Russia, the largest in Europe with the exception of the Volga and the Danube (Map: Russia, D 5). It takes its rise in the swamps of the Government of Smolensk, and after leaving that government flows in a southerly direction as far as Kiev. At that city it turns southeast and maintains that direction down to Ekaterinoslav, where it again turns to the south. In this part of the river the banks are rocky and elevated, and the river forms its famous rapids, which can be passed only at full tide and with the assistance of experienced pilots. Below Alexandrovsk the Dnieper assumes a southwesterly course, emptying into the Black Sea below Kherson, where it forms a wide estuary, known as the Dnieper Liman. The total length of the river is over 1400 miles.

It is navigable for nearly its entire length and is of great commercial importance. Its course affords the main artery of commerce for the 14,000,000 inhabitants of its basin. Its chief western tributaries are the Beresina, Pripet, and Ingulets. On the east its waters are swelled by the Soj, Desna, and Psiol. The basin of the river is estimated at 202,000 square miles, almost entirely within the boundaries of Russia. The lowland watered by the river in its lower course is a region of great fertility. It is here that the famous "black soil" of southern Russia is found. This very fertile loam consists of wash transferred from the Dnieper's upper basin. The waters of the Dnieper abound in fish. There is steam navigation from Orsha, in the northern part of the Government of Mohilev, to Ekaterinoslav, and from Alexandrovsk, below the rapids, to Kherson. The freight carried on the Dnieper consists principally of grain and lumber and has an annual value of about \$60,000,000. The Dnieper communicates with the Baltic Sea through the Beresina Canal, which connects the Beresina with the Dvina, the Oginski Canal connecting indirectly the Pripet, a tributary of the Dnieper, with the Niemen, and the Dnieper-Bug Canal, connecting the Pripet with a tributary of the Vistula. In its upper course the Dnieper is usually frozen over from December to April, while at Kherson, near the mouth, it is ice-bound for only two months, from January to March. In ancient times the Dnieper was known as the Boristhenes, or Danapris.

**DNIESTER**, nê'stêr, *Russ. pron. dnyês'têr*. A river of south Europe, rising in the Carpathian Mountains, near Sambor, in the Austrian Crownland of Galicia (Map: Russia, C 5). It flows in a southeasterly direction through Galicia and enters Russian territory near Khotin, Bessarabia. Its course through Russia, where it separates Bessarabia from Podolia and Kherson, is very tortuous, but has a general southeasterly direction. It empties into the Black Sea between Ovidiopol and Akkerman, forming the Dniester Liman, a shallow sheet of water about 20 miles long and 5 miles wide. The total length of the river exceeds 850 miles, of which over 500 is in Russia. It drains an area of about 30,000 square miles. The Dniester runs mostly through an elevated country. At Yampol rapids formerly interfered with navigation, but they have been partly overcome, and steam navigation begins at Khotin. The chief tributaries of the Dniester are the Stry from the right and the Sereth from the left. The Dniester is rich in fish. Its commercial importance has been much increased owing to improvements introduced by the Russian government. The chief articles of traffic are grain and lumber from Galicia, Podolia, and Bessarabia. In ancient times the Dniester was known as the Tyras, or Danaster.

**DOAB**, dô-âb' or dô-âb' (from Pers. *dû*, two + *âb*, water). A word applied, in Hindu countries, like the Greek *mesopotamia* to any region between two rivers. When introduced, however, without local reference of any kind, the Doab means the land inclosed by the Jumna on the southwest and the Ganges on the northeast—a district extending from Allahabad to the base of the Himalayas, a distance of upward of 500, with an average breadth of 55 miles. The fertility of this region has been much increased by the Ganges Canal (q.v.).

**DOAK**, dôk, **SAMUEL** (1749-1830). An American Presbyterian clergyman and educator, a

pioneer in the movement for the abolition of slavery. He was born in Augusta Co., Va., graduated at Princeton in 1775, studied theology, and was licensed to preach in 1777. He then ministered to the Holston valley, and later to S. C., Tenn., where he established an academy which grew into Washington College, of which he was president from 1795 to 1818. In 1818 he removed to Bethel, Tenn., where he helped to establish and conduct Tusculum Academy, which in 1844 became Tusculum College. He was generally known as "the Presbyterian Bishop." He early became convinced of the iniquity of slavery, freed his own slaves in 1818, and during the rest of his life, both as a preacher and as a teacher, used the whole of his powerful influence to further the cause of immediate abolition. He is frequently referred to as "the apostle of learning and religion in the West." A sketch of his life is given in vol. iii of Sprague's *Annals of the American Pulpit* (New York, 1857).

**DOANE, dön, GEORGE WASHINGTON** (1799-1859). An American bishop of the Protestant Episcopal church. He was born in Trenton, N. J.; graduated at Union College in 1818; studied in the General Theological Seminary, and was ordained a deacon in 1821 and a priest in 1823. He was the assistant of Bishop Hobart in Trinity Church, New York. In 1824-28 he was professor of belles-lettres in Washington (now Trinity) College, Hartford, Conn. He was then successively assistant minister and rector of Trinity Church, Boston, until 1832, when he was elected Bishop of New Jersey. His interest in Christian education soon led him to establish St. Mary's Hall for Girls (1837) and Burlington College (1846), both at Burlington, N. J. He published a volume of poems entitled *Songs by the Way* (1824), besides many familiar hymns, among them "Softly Now the Light of Day." Consult *The Life and Writings of George W. Doane* (4 vols., New York, 1860-61), ed. by his son, Bishop W. C. Doane.

**DOANE, WILLIAM CROSBY** (1803-1883). An American bishop of the Protestant Episcopal church. He was born in Boston and graduated from Burlington College (N. J.) in 1850. Six years later he was ordained priest by his father, Bishop G. W. Doane, whom he assisted in St. Mary's Church, Burlington. He was rector of St. John's, Hartford, Conn., in 1863-67, and of St. Peter's, Albany, N. Y. In 1869 he was consecrated Bishop of the new diocese of Albany. He organized the cathedral of All Saints in Albany and founded St. Agnes's School for Girls. In 1902 he was chosen chancellor of the regents of the University of the State of New York. He published: a biography of his father (1860-61); *Mosaics, or The Harmony of the Collects; Epistles and Gospels for the Sundays of the Year* (1881); *Rhymes from Time to Time* (1901).

**DÖBBELIN, dēb'be-lēn.** See DÖBELIN, KARL T.

**DOB'BIN, MAJOR WILLIAM.** An estimable but awkward young officer in Thackeray's *Vanity Fair*.

**DOBBS FERRY.** A village in Westchester Co., N. Y., 21 miles north of the Grand Central Depot, New York City, on the Hudson River, and on the New York Central and Hudson River Railroad. It is purely a residential suburb of New York and is picturesquely situated at the south end of the broad expansion of the Hudson known as Tappan Bay. The village

has exceptional educational facilities, the Misses Masters School for Girls, the Tophers' Home for Boys and Girls, the New York Juvenile Farm, and a public library; it has also a hospital and playground. Dobbs Ferry's history in connection with the Revolution is interesting. Here, in the old Livingston manor house, Washington and Rochambeau planned the Yorktown campaign; the same mansion is famous for the conference of Washington, Clinton, and Carleton in 1783; and opposite this point was fired the first salute to the American flag by a British sloop of war. Pop., 1900, 2888; 1910, 3455.

**DÖBELIN, dē'be-lēn, KARL THEOPHILUS** (1727-93). A German actor, born at Königsberg (East Prussia). He studied at Halle and Leipzig and in 1756 established at Erfurt his own dramatic company. From 1758 to 1789 he was a member of several companies and subsequently laid the foundations of the court theatre in Berlin. He did much to promote the presentation of the dramas of Lessing.

**DOBELL, SYDNEY THOMPSON** (1824-74). An English poet, born at Cranbrook, Kent. His father, who was a wine merchant, removed to Cheltenham in 1836, and Dobell was educated there by private tutors and by himself. In 1844 he married and, owing to his own ill health or his wife's, made many tours abroad, living for three years in Edinburgh and the Highlands, and finally making his home among the Cotswold Hills, where he died. He was a friend of Tennyson, Browning, and Carlyle, of Ruskin and Holman Hunt, and of others of the men best worth knowing of his day. His poems comprise: *The Roman* (1850); *Balder* (1854); *Sonnets on the War*, written in conjunction with Alexander Smith (1855); *England in Time of War* (1856). Dobell belongs to the so-called "spasmodic" school of poets, of whom the extreme type was P. J. Bailey (q.v.). He possessed the true poet's spirit, but was weak in execution. He was a reputable critic and a man of lofty character. Consult: his *Poetical Works*, with a memoir by J. Nichol, published in 2 vols. (London, 1875), the standard edition; *Thoughts on Art, Philosophy, and Religion*, ed. by Nichol (London, 1878); *Life and Letters*, ed. by Jolly (London, 1878). See POETRY, SPASMODIC SCHOOL OF.

**DÖBELN, dē'bēln.** A town in the Kingdom of Saxony, situated on an island in the river Mulde, 42 miles southeast of Leipzig (Map: Germany, E 3). Among other institutions are a form of pottery, a brewery and an agricultural and manufacturing school. Döbeln is a pretty and thriving place, and has manufactures of woollen yarns, iron, wagons, pianos, cigars, cooperage, sugar, dyes, cloth, leather, and agricultural implements. It has an active trade in cereals. Pop., 1900, 17,745; 1905, 18,900; 1910, 19,627. Consult Markel, *Döbeln und Umgeben* (Döbeln, 1893).

**DÖBEREINER, dē'bēr-i'nēr, JOHANN WOLFGANG** (1780-1849). A German chemist, born near Fiof (Bavaria). He studied pharmacy at Münchenberg and in 1810 was appointed professor of chemistry and pharmacy at Jena. Goethe and the Grand Duke Karl August of Saxe-Weimar were his friends, and the *Briefe des Grossherzogs Karl August und Goethes an Döbereiner* were published at Weimar in 1856 (ed. by O. Schade). He is best known as the inventor of "Döbereiner's lamp," considerably used previous to the intro-

duction of sulphur matches. In this apparatus a platinum sponge upon which a jet of hydrogen is directed becomes red-hot and ignites the gas. His publications include: *Zur pneumatischen Chemie* (1821-25); *Zur Chemie des Platins* (1836); and other works. Consult Kragenberg, *Die Bedeutung Dobreiners* (Jena, 1862).

**DOBLHOFF-DIER**, dōb'l'-hōff-dēr, ANTON, BARON (1800-72). An Austrian statesman. He was a member of the Assembly of Lower Austria and in this capacity revealed himself as a man of decidedly liberal and progressive views. In May, 1848, he was appointed Minister of Commerce and two months later accepted the portfolios of the Interior and of Education. In 1849-58 he was Minister to The Hague. In 1867 he became a life member of the House of Lords.

**DOBNER**, JOB FELIX (1719-90). A Bohemian historian. At an early age he joined a monastery, his cloister name being GELASIUS A SANTA CATHARINA. He was born at Prague, where he was appointed royal historiographer because of his original researches into the domain of Bohemian history. The Bohemian Society of Sciences erected a monument to his memory. His own works, as well as the numerous treatises published by the society mentioned, still have considerable scientific value. His principal publications are: *Wenceslai Hagek a Liboczan Annales Bohemorum e Bohemica Editione Latine Redditi et Notis Illustrati* (6 vols., 1761-83) and *Monumenta Historica Bohemica nusquam ante hac Edita* (6 vols., 1764-86). For his rare critical acumen and his publication of monumental historical works in his native tongue, Dobner has been called the founder of Bohemian historiography.

**DOBREE**, PETER PAUL (1782-1825). An English classical scholar, born in the island of Guernsey. He graduated at Trinity College, Cambridge, in 1804, was appointed fellow of Trinity in 1806, and regius professor of Greek in 1823. He devoted himself to the classics and enjoyed the intimate friendship of Porson, whose notes on *Aristophanes* he published in 1820, 12 years after Porson's death, with an edition of the *Plutus*; in 1822 he edited Photius' *Lexicon* after Porson's notes. His own notes on various Greek and Latin authors were published in 1831-33, in 4 vols., under the title *Adversaria*. A small volume containing *Miscellaneous Notes on Inscriptions* was added in 1835. Consult Luard, in *Dictionary of National Biography*, vol. xv (London, 1888), and Sandys, *A History of Classical Scholarship*, vol. iii (Cambridge, 1908).

**DOBRICTH**, a town of Bulgaria. See BAZARJIK.

**DOBROLUBOV**, dō-brō-lōō'bōv, NICKOLAI ALEXANDROVITCH (1836-61). A Russian critic of the same school as Belinsky and Chernyshevsky (qq.v.). Born at Nizhni Novgorod, of cultured parents, he learned Krylov's fables when only three years old. At 10 he entered a clerical school, where his brilliant abilities excited the envy of his older classmates. At 17, forbidden by his father (a parish priest) to attend the University, he entered the St. Petersburg Pedagogical Institute. There he continued his remarkable development, failing of a gold medal owing to his participation in certain student activities. At 18, losing both his parents, he had to support not only himself, but all his brothers and sisters. Hard work so

undermined his health that he died of tuberculosis at 25, only four years after his literary career began. His best work, consisting of literary criticism, appeared in the *Contemporary*, a famous Russian periodical. These critical essays fill four large volumes. Dobrolubov was one of the greatest Russian critics. His influence upon Russian thought in the sixties—when Anglo-French utilitarianism was supplanting Hegelian metaphysics—cannot be overestimated.

**DOBROVSKÝ**, dō-brōv'skē, JOSEF (1753-1829). A Bohemian writer, the "patriarch of Slavonic philology." He was born in Hungary, where his father was stationed in garrison. His education was carried on in German, and he learned his native tongue from his schoolmates when a boy of 10. He studied in Deutschbrod, Klattau, and Prague, and entered the Order of Jesuits, but 10 months later, on its dissolution in 1773, returned to Prague and acquired a solid reputation through his knowledge of Hebrew and his theological scholarship. While tutor in the family of Count Nostitz (1776-87), he had the necessary leisure to devote himself to scientific pursuits and gradually developed into an ardent student of everything connected with the Bohemian nationality, antiquities, language, and literature. In 1780-87 issued several periodicals, dealing with those questions. Appointed subdirector (1787) and then rector (1789) of the General Seminary at Hradisch, near Olmütz, he made many enemies by his outspokenness and fearless criticisms of men prominent in the political and social life of the country. In 1790 the seminary was closed, and Dobrovský retired into private life. Two years later the Royal Bohemian Scientific Society, then recently founded, sent him on a scientific mission. At the society's expense, Dobrovský visited Denmark, Sweden, Finland, and Russia in 1792, and Germany, Switzerland, and Italy in 1794, in search of ancient Bohemian manuscripts and books plundered during the Thirty Years' War. In 1801 he manifested symptoms of insanity. Though he soon recovered from the first attack, the fits of mental aberration kept recurring until his death. When out of his mind, Dobrovský was eager to destroy his works, and it was during one of these fits that he burned the manuscript of the Lusatian Dictionary, which was ready for the press.

Although one of the most brilliant scholars in the period of the revival of Slavonic studies (q.v.), Dobrovský did not believe in the possibility or even desirability of a Bohemian renaissance, his favorite advice to the enthusiasts being, "Leave the dead alone." His interest in the literary remains of the nation did not go beyond scientific investigation. This difference from the point of view of the younger enthusiastic scholars turned into a serious breach when Dobrovský attacked the authenticity of the famous *Judgment of Libusha*, discovered by Hanka in 1817. Jungmann, Hanka, Celakovsky, Palacký, and even Safarik bitterly denounced him as a "Slavonizing German," but Dobrovský, though keenly grieved at the animosity of his erstwhile friends, never changed his views. His principal works are: *Scriptores Rerum Bohemicarum* (1783-84); *Geschichte der böhmischen Sprache und ältern Litteratur* (1792; 2d ed., 1818); *Die Bildsamkeit der slavischen Sprache* (1799); *Deutsch-bohmischer Wörterbuch* (1802-21); *Lehrgebaude der böhmischen Sprache*

(1809; 2d ed., 1819), the first scientific exposition of the structure of the Czech language, remarkable for its analysis of the formation of words from roots and for the simplified theory of inflections and consonants and consonants; and *Institutum Linguae Slavicae Dialecti Veteris* (1822), an epoch-making work in its field.

**DOBRUDJA**, dô-brûd'já, or **DOBROGSA** (anciently *Scythia Minor*). A name applied to the southeastern portion of Rumania (q.v.), bounded by the Danube on the north and west, Bulgaria on the south, and the Black Sea on the east. Its area was formerly about 6000 square miles, but, including the territory added to it by the Treaty of Bucharest of Aug. 10, 1913, is about 9500 square miles (Map: Balkan Peninsula, G 2). Pop., 1880, 147,246; 1899, 267,808; 1905, 297,800, consisting of Rumanians, Tatars, Circassians, Turks, Greeks, Armenians, and Jews. After the Balkan War of 1912-13 its population increased to about 500,000 inhabitants. Before 1878 it belonged to Bulgaria. The Dobrudja is an exceedingly fertile district. Agriculture is the principal occupation of its inhabitants. Cereals, tobacco, beet, vines, and mulberry are the chief agricultural plants raised. For further details, see **RUMANIA**.

**DOBSCHÜTZ**, dôp'shûts, **ERNST VON** (1870- ). A German biblical critic. He was born in Halle; was educated at the universities of Leipzig, Halle, Berlin, and Jena, where he was professor extraordinary in 1899-1904; and then in succession was professor at Bonn (1904-1910), and Halle (1913; exegesis). His most important published works treat the history of the apostolic age; they include: *Kerygma Petri* (1893); *Studien zur Textkritik der Vulgata* (1894); *Die urchristliche Gemeinde* (1902, probably his greatest work; in English, *Christian Life in the Primitive Church*, 1904); *Problème des apostolischen Zeitalters* (1904); *Das apostolische Zeitalter* (1905; in Swedish, French, and English versions), "Thesalonians," in *Meyers Kommentar* (7th ed., 1909); *The Eschatology of the Gospels* (1910); *Das Decretum Gelasianum* (1912); *The Influence of the Bible on Civilization* (1914).

**DOBSON**. See **CORYDALIS**.

**DOBSON**, (HENRY) **AUSTIN** (1840- ). An English poet and critic. He was born at Plymouth and was educated at Beaumaris, Cornwall, and Strassburg. He intended to adopt the profession of his father, civil engineering, but in 1856 entered the Board of Trade as a clerk, from which he did not retire until 1901. In 1868 he published some poems in Trollope's *St. Paul's Magazine* and soon attracted attention by his skillful and graceful handling of French artificial forms of verse—the rondeau, ballade, and others—and by his delicate satire. George Eliot was among those who early recognized the fine quality of his literary and poetical gifts. In 1902 he received the degree of LL.D. from the University of Edinburgh. Among his volumes of poetry are: *Vignettes in Rhyme* (1873); *Proverbs in Porcelain* (1877); *Old World Idylls* (1883); *At the Sign of the Lyre* (1885). His collected poems first appeared in 1897 (9th ed., 1913). His prose includes: *lives of Hogarth* (1879; enlarged, 1900); *Fielding* (1883); *Steele* (1886); *Goldsmith* (1888); *Richardson* (1902); and *Fanny*

*Burney* (1903); *Thomas Bewick and his Pupils* (1884); *Memoir of Horace Walpole* (1890); *The Paladin of Philanthropy* (1899); *Eighteenth-Century Vignettes* (3d series, 1892, 1894, 1896); *Sidewalk Studies* (1902); *Old Kensington Palace* (1910); *At Prior Park* (1912). He was also active as an editor, especially of eighteenth-century authors, and notably of Gay, Goldsmith, Steele, Richardson, and Madame D'Arblay—the *Diary*. All his work, including a large number of contributions to the more important magazines and reviews, to encyclopedias, and to the *Dictionary of National Biography*, is marked by scholarship, an exacting taste, and literary finish, grace, and charm.

**DOBSON**, **WILLIAM** (1610-46). An English portrait painter. He was born in London and studied under the engraver Robert Peake and the German painter Franz Cleyn; but his principal artistic training was gained as assistant to Van Dyke, who strongly influenced his art. He was presented to Charles I by Van Dyke, and after the latter's death was appointed court painter. Dobson painted portraits of the King, the Prince of Wales (Windsor Castle), and members of the royal family and the court, including the Earl of Essex (Knole Park), Lord and Lady Fairfax (National Portrait Gallery, London), and Endymion Porter (National Gallery), one of his finest achievements. The color and brushwork of his last period, which began after 1640, show also the influence of Tintoretto, for which reason he was called the "English Tintoretto" by Charles I. Dobson's extravagance resulted in his imprisonment for debt under the *Proclamation*, shortly before his death. Many of his portraits are in English private collections; others are at Windsor Castle, Hampton Court, and in the National Portrait Gallery. His few historical and religious pictures are of less importance.

**DOCEN**, dô'tsen, **BERNHARD JOSEPH** (1782-1828). A German philologist, born at Osnabrück. He studied at Göttingen, where he was a pupil of Heyne, and at Jena, and from 1804 was connected with the State library at Munich, of which he was, in 1811, appointed custodian. His reputation is based largely on the critical examination of the Old and Middle High German manuscripts, which were deposited at Munich in consequence of the secularization of the cloisters in Bavaria. He was the first to call attention to the importance, in the study of the history of the German language, of the short fragments of early prose, the first Latin-German dictionaries, and the German glosses to Latin manuscripts of the period from the eighth to the twelfth century. He was one of the editors of the *Museum für altdutsche Literatur und Kunst* (2 vols., Berlin, 1809-11). Among his publications may be cited the *Ussellaneen zur Geschichte der deutschen Literatur und Kunst* (2 vols., Munich, 1807-09).

**DOCENT**, dô-tsént' (Lat. *docere*, 'to teach'). A teacher in German universities, with full official relations. In its more general sense the term includes professors of all grades and the privatdocent (q.v.). In American universities it indicates a member of the teaching staff of the lowest grade. In Clark University (q.v.) it is a distinction bestowed annually upon those "whose work has already marked a distinct advance beyond the doctorate and who wish to engage in research." The appointee is expected to deliver some lectures, may receive a salary,

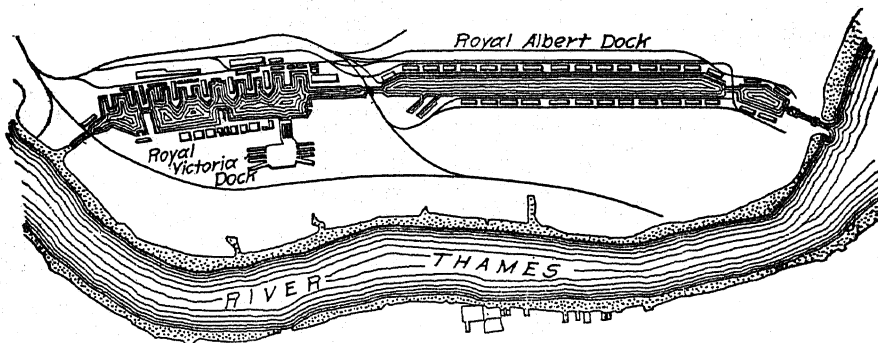
and may be "formally invested with the *licentia docendi* . . . the highest formal academic honor." in the University of Chicago (see CHICAGO, UNIVERSITY OF), *docent* is a rank just above that of fellow. See UNIVERSITY.

**DOCE'TÆ** (Lat., from Gk. Δοκῆται, *Dokētai*, from *dokein*, *dokein*, to seem). The name given in the early Church to those who held that the material body and human nature of Jesus Christ were a semblance and not a reality. Gnosticism could not conceive the real union of the divine nature with a body composed of matter, which they held to be the seat of all evil. When some Gnostics became Christian, they met the difficulty in one of three ways: the body of Christ was either considered a real earthly body, but not belonging essentially to His nature and only assumed for a time; or it was declared to be a mere appearance or illusion; or, finally, it was believed to be a heavenly body, composed of ethereal substance, though having the appearance of being material. Most Gnostic Christians held Docetism in one or other of these three forms, though some denied the divine nature of Jesus Christ and reduced him to a mere human sage. Later, Docetism appeared in other sects, as the Manichæans (q.v.), and even Clement of Alexandria and other Church fathers have been charged with this tendency. Consult the *Histories of Doctrine*, by Fisher (New York, 1896), and Harnack (trans. by Buchanan, Boston, 1894-1900). See GNOSTICISM.

only in the water in which the ship floats, but that body of water becomes a dock only by virtue of the walls which more or less completely surround it, the gates (in the case of the wet dock) which maintain it on even level, and the warehouses, service railways, and freight-handling machinery which line its sides.

Wet docks are common to the ports of England, France, South America, and the Orient at places where the tide ranges are higher than 10 feet. A few of the large ports so equipped are London, Liverpool, Cardiff, Aberdeen, Dublin, Swansea, and Dunkirk, in Great Britain; Havre, Marseilles, Rouen, and St. Nazaire, in France; Hamburg and Kiel, in Germany; Calcutta, in India; Cape Town, in South Africa; Antwerp, in Belgium; Buenos Aires, in Argentina, and Hongkong, in China.

The wet dock is normally an extensive basin walled off from the tidal sea by a lock chamber and a swinging gate similar to those used in canal locks (see CANAL), or more rarely by a specially shaped caisson gate which is floated into place. It is provided with a number of piers, quays, or wharfs at which vessels may be moored. On account of variation in design, due primarily to geographic and topographic conditions, the different docks of the world cannot be classified into types and described as such; so a description is given below of one London wet dock, which will exemplify the general principles of their design.



ROYAL ALBERT AND VICTORIA DOCKS, LONDON, ENGLAND.

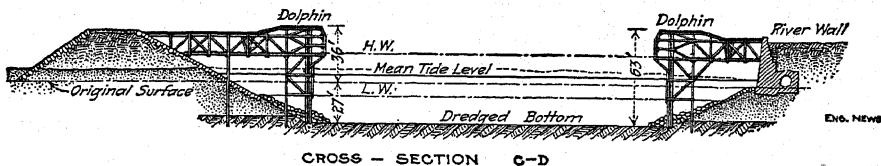
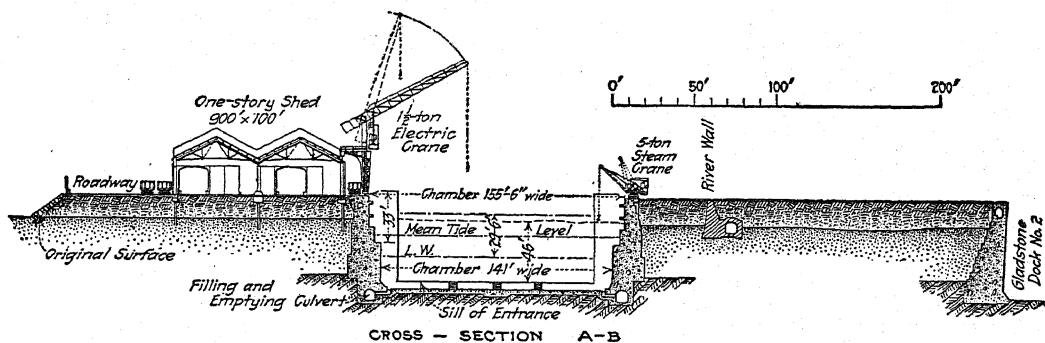
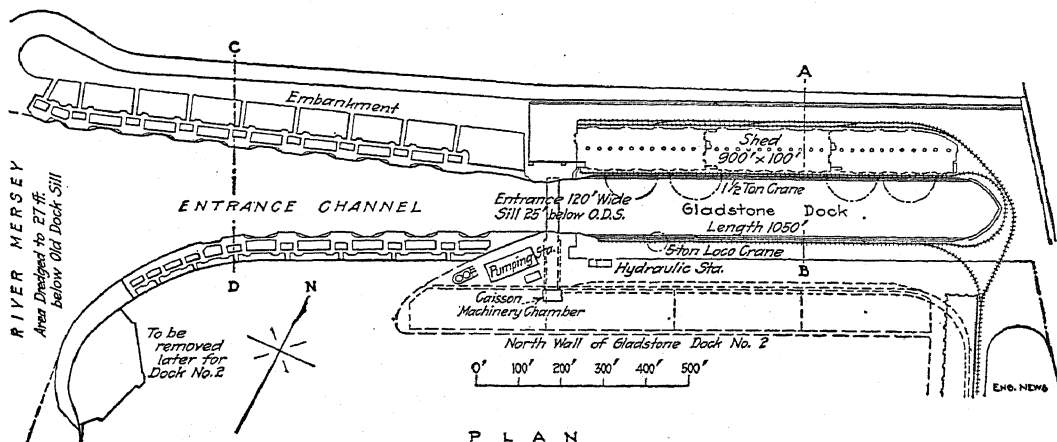
**DOCK** (Ger. *Dock*, of uncertain origin). Any space or structure in or upon which a ship may be berthed or held for loading, unloading, repairing, or safe-keeping. Docks are of two kinds—wet docks, with the subclass of tidal locks; and dry docks, with the subclass of floating docks. A wet dock is a basin surrounded by quays, the entrance to which is closed by a gate and in which the water level is constantly at the same height; they are employed where the range of tide is considerable, such as at Liverpool with 30-foot difference in tide level. A tidal dock is a similar basin open to the harbor waters, in which the water level fluctuates with the rise and fall of the tides; they are employed where the tide variation is so low as not to cause serious inconvenience to vessels moored in the dock.

**Wet Docks.** The wet dock and the tidal dock, more commonly known by the general term "dock," are primarily for the purpose of berthing vessels for loading and unloading and are a part of the great port systems in the service of commerce. Fundamentally the dock consists

The Royal Albert and Victoria docks at London (see figure) are excavated across a neck of land formed by a bend in the river Thames and thus have two entrances, one at each end. Beginning at one end, there is a dock 350 feet long and 80 feet wide, which opens into a basin that is separated by a gate from the Royal Albert Dock. This dock is 6500 feet long and 490 feet wide and has an area of 84 acres. A channel 80 feet wide connects the Royal Albert Dock with the Royal Victoria Dock. This dock is 1050 feet wide and has a series of jetties or piers on one side to increase the amount of quay space; the total area is 74 acres. The Royal Victoria Dock opens into a tidal basin 16 acres in area, which in turn opens into the Thames by means of a canal and lock. The depth of water in the Albert Dock is 30 feet and in the Victoria Dock 28 feet.

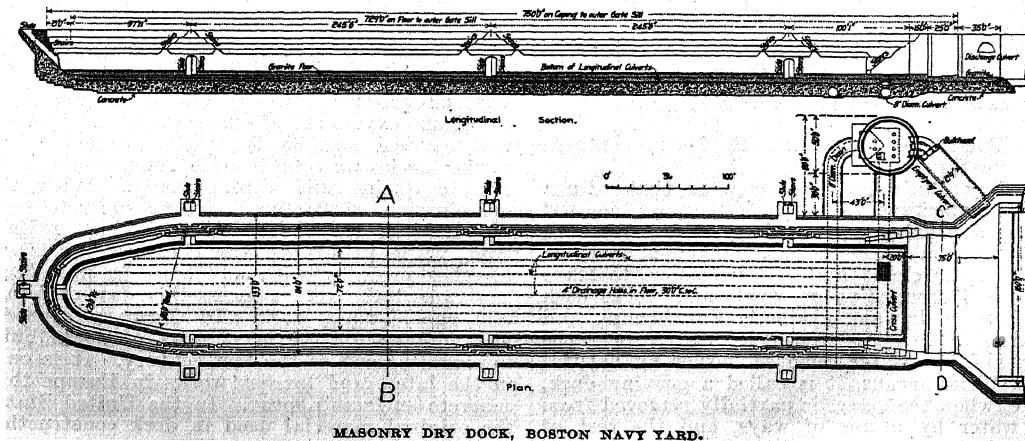
Only one wet dock with gates exists in the United States; that is at the port of Seattle, Washington, and is now in course of construction. The lock is a double structure, comprising a large chamber for heavy shipping, log

rafts, etc., and a small chamber for the use of small boats. The larger lock will be 825 feet long and 80 feet wide and will have a maximum sound and are located at the outlet of Salmon Bay, 1 mile inland from deep water. Tidal Docks are adapted to locations where



THE GLADSTONE WET AND DRY DOCK, LIVERPOOL, ENGLAND. OPENED, 1913.

depth of 36 feet. The small lock will be about 150 × 30 × 16 feet deep. The locks are to be used to separate the main harbor from the the range of the tides is small, as along the Atlantic and Gulf coasts of the United States, where this range varies from 9 feet on the New

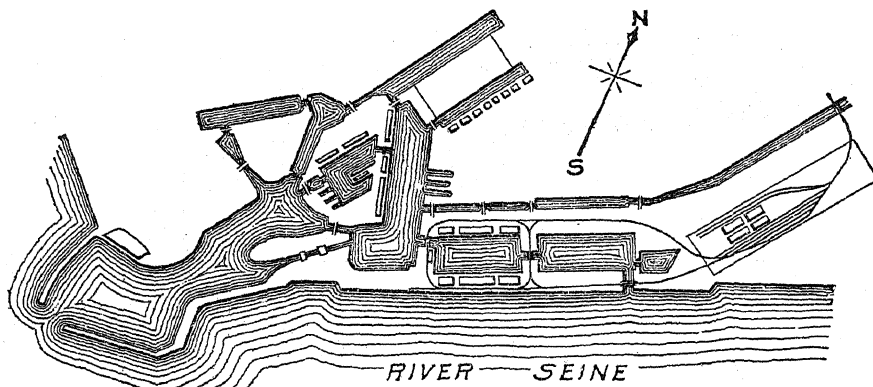


MASONRY DRY DOCK, BOSTON NAVY YARD.



England coast to about 2 feet at Galveston, Tex., at the Mediterranean ports, at Glasgow, Scotland, and Hamburg, Germany. The almost universal form of dock in America is a series

of rectangular water spaces between piers which project out from the bulkhead line, although tidal-basin docks are found in a few places. The Atlantic Docks and the Erie Basin in Brooklyn are examples. The Atlantic Docks were commenced in 1841 and were several years in construction. More than 200 acres of land were secured by the Atlantic Dock Company, and 40 acres of low marshland were converted into a basin. Excavation over the whole 40 acres was done mainly with dredges and was carried to a depth of 20 feet below low-water mark. The outer inclosure was made with piers of cribwork, consisting of timber filled with stone, which were sunk into trenches 30 feet below high-water mark. The cribs were 25 feet thick at the base and were placed 150 feet apart, that being the width of the pier. In the basin are a number of wooden piers where vessels are loaded. Upon the cribwork piers large stone warehouses are built. On the inland side is the commercial wharf, 2000 feet in length. The



DOCKS AT HAVRE, FRANCE.

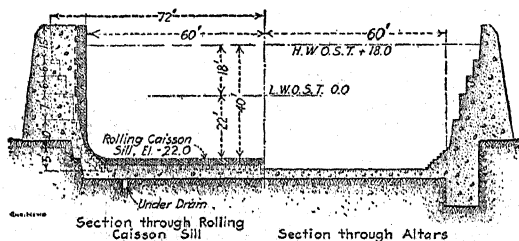
least one of the entrance locks to all of the large wet docks is so arranged as to be available as a graving dock.

#### LARGE GRAVING DOCKS OF THE WORLD

	Length feet	Entrance Width feet	Depth feet
ENGLAND (Commercial)			
Newport.....	1,000	100	64
Bristol.....	875	100	34
Liverpool.....			
Canada Dock.....	925	94	32
Gladstone Dock.....	1,020	120	44
ENGLAND (Naval)			
Chatham.....	650	83	33
Portsmouth.....	850	110	47
Rosyth.....	750	100	40
GERMANY			
Kiel*.....	574	98	37
Wilhelmshaven.....	820	131	36
FRANCE			
Cherbourg.....	820	118	46
Brest.....	820	118	46
UNITED STATES			
Brooklyn Navy Yard.....	700	110	36
Seattle Navy Yard.....	863	143	47
Boston (city).....	1,162	120	45
CANADA			
Quebec†.....	1,150	120	45

\* A 1000-ft. dock is to be provided at Kiel as one of the locks of the enlarged Kiel Canal.

† Under construction, 1914.



CROSS SECTION OF LEVIS DRY DOCK, CANADA.

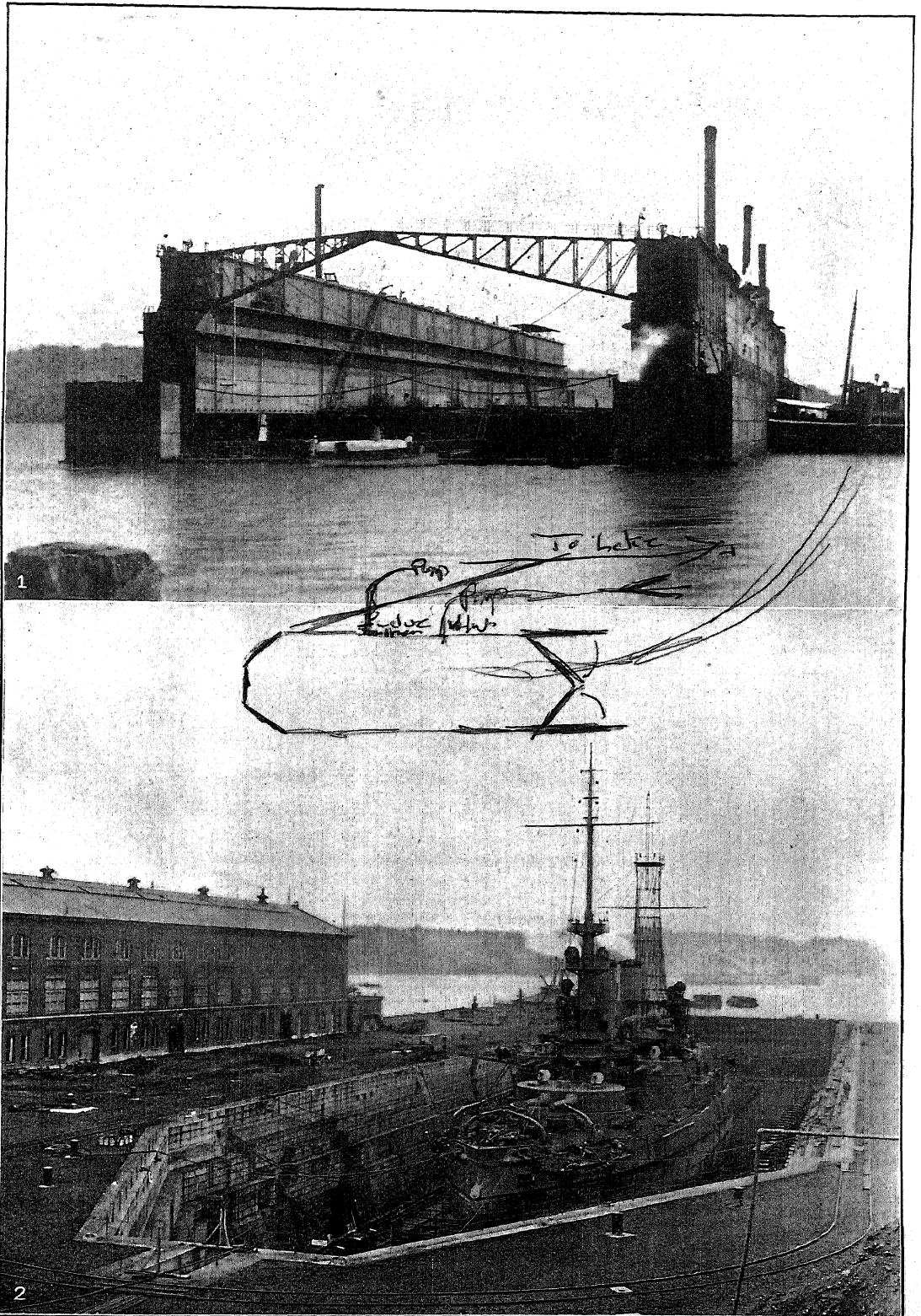
Erie Basin, near the Atlantic Dock, contains two graving docks.

A **Dry Dock** is a masonry or timber-lined basin connecting with the harbor waters and having approximately the shape of a ship's hull, into which a vessel can be floated and which can then be closed and emptied so as to leave the vessel propped up on struts and blocks with the bottom dry and available for cleaning and repairs. When the vessel is floated into the dock and the water removed, either by natural or artificial means, it is called a graving dock, while, when the vessel is partially removed from the water by means of ways, and the rest of

**Material.** Before the advent of Portland cement concrete most docks were built of rough stone faced with cut granite. In France and England particularly the old docks are very excellent examples of masonry and show well coursed and bonded faces. Some of the earlier docks were built with rough stone with granite quoins and copings only. With the introduction of Portland cement concrete took the place of the rough stone backing in England, while in France the cheapness of labor, together probably with adherence to precedent, has caused the retention to this day of hand-laid rubble mass work. In Germany concrete was adopted for the mass work of docks built towards the end of the last century. It is only in the latest and largest works in Europe that concrete surfaces appear. In the United States the original material used in dock construction



## DOCKS



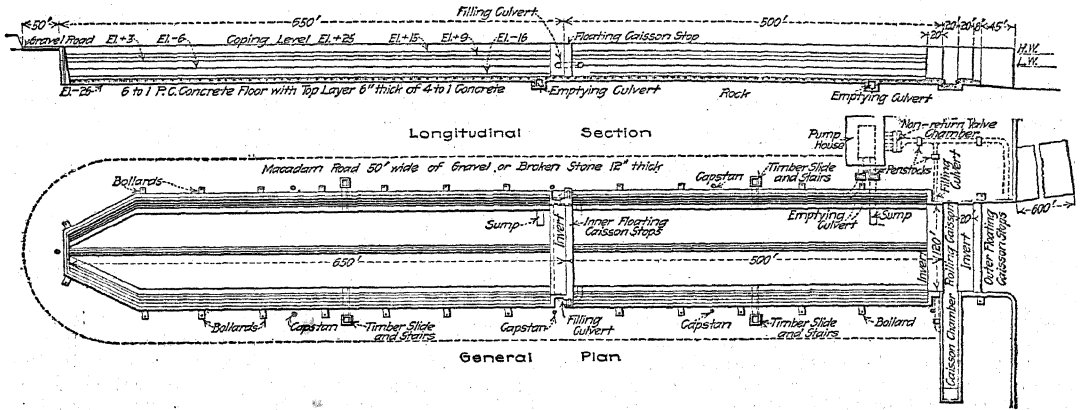
1. UNITED STATES NAVY FLOATING DRY DOCK "DEWEY."

2. DRY DOCK No. 2, NAVY YARD, PUGET SOUND, WASHINGTON. U. S. S. "Oregon" in Dock.



was timber, except in the case of some of the earlier dry docks of granite in the United States navy yards, but with the advent of concrete it has been largely applied to dry-dock construction. As noted above, there are practically no wet docks in the United States.

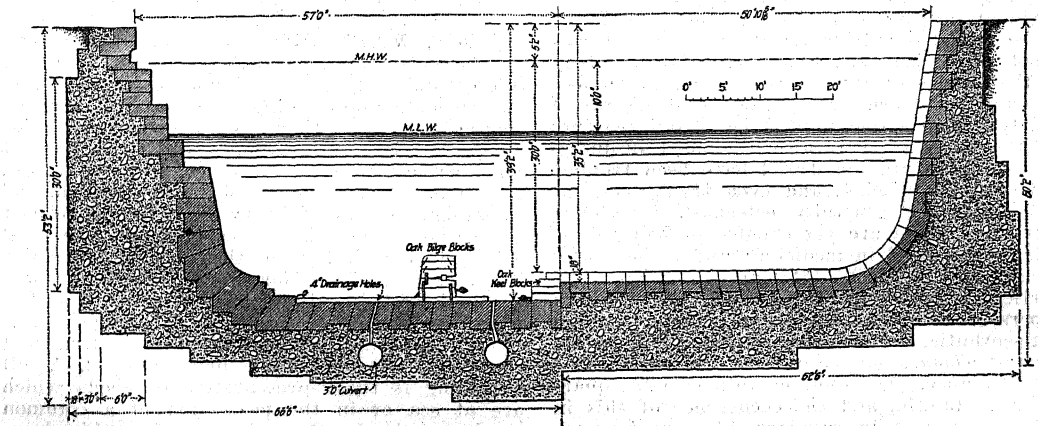
of five pontoons or water-tight boxes. Three of these compose the bottom of the dock, while two form the side walls. These pontoons are divided by means of partitions into 40 water-tight compartments, and each has an inlet for the admission of sea water and an outlet connected



THE DRY DOCK AT LEVIS ON THE ST. LAWRENCE RIVER OPPOSITE QUEBEC. UNDER CONSTRUCTION, 1914.

Floating Dry Docks have been built in considerable numbers in both Europe and America, the majority of them being for vessels of from 2000 to 4000 tons. They are of steel or iron frame and plate construction, in design similar

by piping with steam pumps for expelling the water. The vessel is floated in and carefully centred over the keel blocks, and the pumps are then set to work to remove the water from the compartments. As the dock raises the vessel



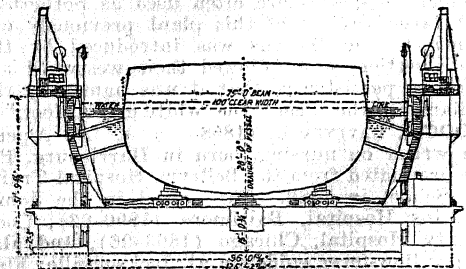
Half cross section, through dock.

Half cross section, through entrance.

CROSS SECTION MASONRY DRY DOCK, BOSTON NAVY YARD.

to ships. The latest and largest floating docks are given in the accompanying table.

Place	Date	Material	Length	Width bet. walls	Draft of vessel	Lifting capacity	Cost
New Orleans.	1901	Steel	525	100	23.0	15,000	\$810,000
Havana.	1897	Iron	450	82	27.5	10,000	1,000,000
Bermuda.	1902	Steel	545	100	32.0	15,500	1,350,000
Philippine Is.	1905	Steel	500	100	32.0	16,000	1,124,000
Rotterdam.	1892	Iron	361	...	...	6,000	327,000
Rotterdam.	1903	Iron	557	95	27.0	14,000	486,000
Amsterdam.	1899	Iron	429	78	20.0	7,000	281,000
Hamburg.	1909	Steel	720	103	25.0	35,000	...
Kobe.	1908	Steel	532	70	26.0	12,000	...



SECTION OF THE ALGIERS FLOATING DRY DOCK.

The New Orleans (Algiers) Dock, shown here with holding a 15,000-ton battleship, consists

out of the water, shores are inserted between the vessel's hull and the side walls, and the pumping is continued until the floor of the dock

is raised above the water level. The Philippine Island dry dock, *Dewey*, was constructed at Sparrows Point, Md., in 1905 and towed to the Philippines. It is in three sections, so as to be self-docking. If the central section, which is 316 feet long, is to be docked, the two end sections are detached, placed beneath it and exhausted of water, while if the end sections are to be docked they are placed in the mid-section as a vessel would be, and it is pumped free of water. The dock is operated by steam.

Consult: Colson, *Notes on Dock Construction* (London, 1894); Stevenson, *Design and Construction of Harbors* (ib., 1886); Cunningham, *Principles and Practice of Dock Engineering* (2d ed., ib., 1910); Cardemoy, *Les ports modernes* (Paris, 1900); Staniford, *Report on the Physical Characteristics of European Seaports* (New York, 1911). Consult also the proceedings of the various engineering societies and the engineering journals.

**DOCK** (AS. *docce*, probably connected with Gael. *dogha*, burdock). A name applied to those species of the section *Lapathum*, of the genus *Rumex*, which are not acid or only slightly so, and of which the flowers are perfect or polygamous. The other species are generally called sorrel (q.v.). The docks are mostly large, perennial, herbaceous plants, natives chiefly of temperate climates, with large, generally lanceolate or ovate leaves, and panicles of small greenish flowers. They multiply rapidly by seed, have great taproots, and are with difficulty eradicated from pastures. The best mode of dealing with them is generally found to be repeated cutting away of the leaves and shoots, by which the plants are killed. Many of the species prefer watery places. A number are natives of the British Isles, and several of the European species have been introduced into North America, where also a number of indigenous species are found and have been troublesome weeds. Useless and even troublesome as the docks are generally esteemed, the large, astringent roots are yet capable of being beneficially employed in medicine; and those of the greater water dock (*Rumex britannica*), in particular, for which the Druids entertained a superstitious veneration, are administered as an antiscorbutic, astringent, and tonic. Those of *Rumex crispus*, the yellow dock, are used in the same manner. The roots contain variable quantities of tannin, and the occurrence of this in large quantities in canaigre (*Rumex hymenosepalus*) (q.v.) has been made use of in tanning fine grades of leather. The young leaves of a number of species are often used as potherbs.

A large variety of this plant previously unknown to the Indians was introduced by the white settlers and followed their westward advance so persistently that it was named by the Indians of the west "the white-man's foot."

**DOCK**, LAVINIA L. (1858- ). An American writer on nursing, born in Harrisburg, Pa. She graduated from the Bellevue Hospital Training School in 1886. She served in the Johns Hopkins Hospital, Baltimore (1890-93), Cook County Hospital, Chicago (1893-96), and also in a yellow-fever epidemic at Jacksonville, Fla., and at the Johnstown (Pa.) Flood. In 1898 she became a resident member of the Nurses' Henry Street Settlement in New York City. She was elected secretary of the American Federation of Nurses and of the International Council of Nurses. Her writings include: *Text-*

*Book of Materia Medica for Nurses* (1889; 4th ed., 1905); *History of Nursing* (1907; vols. iii, iv, 1912), with M. Adelaide Nutting; *Hygiene and Morality* (1910).

**DOCKET** (also, obsolete or rare forms, *doquet*, *doquet*, *dogget*; probably a diminutive noun from *dock*, to shorten, from *dock*, Icel. *dokr*, stumpy tail). In law, an official record of judicial proceedings. Originally the term was used to denote a brief summary of the contents of a document upon which it was indorsed. It is probable that these memoranda in time came to be transcribed in a book to which the name of docket was then applied. This was particularly the case with records of judgments, and in the United States a register of money judgments is called a docket. Under statutes giving judgments the force of liens on the real estate of the judgment debtor, it is not the rendering or the "entry" of the judgment, but its docketing, which gives it that effect.

But the principal use of the word "docket" in the United States is as the name of a list of causes before the court for trial, entered in the order in which the case is to be called, in a book kept by the clerk of the court. Such a docket is called by the practice of some courts the calendar. The docket, or calendar, is usually called over at the opening of the court each day in order to ascertain what cases are ready for trial and to determine the order in which they shall be heard. The term "docket" is also employed in England to designate a copy of a chancery decree left with the proper clerk of the court for enrollment.

**DOCK WARRANT.** A written instrument, in the nature of a warehouse receipt, given by a dock owner to the consignor of goods therein described, acknowledging their receipt and engaging to deliver them to the owner or to his assignee. It differs from a bill of lading at common law in that it is not, like the latter, a symbol of the goods for which it is given, and its assignment and delivery, even to a purchaser of the goods for value, does not have the legal effect of a delivery of the goods themselves. The reasons assigned for this difference are two: 1. A bill of lading is an ancient mercantile document governed by the rules of the law merchant, while a dock warrant is modern and controlled by common-law principles. 2. A bill of lading is the representative of goods which are at sea or in the possession of a common carrier on land. One who transfers this document does all that is possible for him to give possession of the goods to the purchaser. On the other hand, it is always possible for parties to a sale and purchase of goods in a dock owner's possession to make an actual transfer of that possession.

The foregoing doctrine of the common law has been changed by the Factors Act in England, which puts dock warrants on the same footing with bills of lading. As a species of warehouse receipts, they are declared by statute to be negotiable in many of our States.

Consult: Blackburn, *Contract of Sale* (2d ed., London, 1885); Benjamin, *Treatise on the Law of Sale of Personal Property* (7th ed., Bennett, ed., Boston, 1899); Stevens, *The Elements of Mercantile Law* (4th ed., London, 1903); Bonstead, *Commercial Laws of the World: America*, vol. xvii (ib., 1913).

**DOCTOR** (Lat., from *docere*, to teach). A title formerly used, in accordance with its deri-

vation, to signify a teacher in general; in more recent times it is a title of honor conferred by universities. The word had long been used as a general term for teacher, before it came to designate degree or rank in the learned hierarchy, to which only the united body could advance the candidate. In this sense it seems to have been first used at Bologna about the middle of the twelfth century—not earlier, as it is never found applied to the learned Irnerius, the regenerator of the Roman law at that period, who called himself *judex*, and was called by others *magister*, *dominus*, or *causidicus*. The first to bear it were the so-called “four doctors”—Bulgarus, Martinus, Jacobus, and Hugo. When it began to be formally bestowed, it conferred the unrestricted right to teach, and a voice in the granting of degrees to others. Originally confined to teachers of civil law, by the end of the century it was also applied to canonists; a decretal of Innocent III proves the existence of *doctores decretorum* as well as of *doctores legum*. This distinction between the two branches of the law has left a trace even to the present day in the degree granted by some universities in Germany and America of J.U.D., *juris utriusque doctor*, ‘doctor of both laws,’ and in the more familiar LL.D., where the double L stands for the plural *legum*. In the thirteenth century doctors of medicine, grammar, logic, and philosophy are found; the jurists, however, seem to have attempted to limit the use of the title to themselves, leaving that of *magister* to the theologians and others. The University of Paris almost immediately followed in the footsteps of Bologna, the first bestowment of doctors having taken place in the year 1145, in favor of Peter Lombard and Gilbert de la Porée, the greatest theologians of the day. The emperors were accustomed to grant the universities the right of appointing doctors of law by their authority and in their name; in the same way the popes conferred the right in regard to canon law. Throughout the Middle Ages, however, there was a tendency to use indiscriminately the titles of master, doctor, and professor. In the University of Paris, and others which closely imitated it, the term “master” was commonly used in the faculties of medicine, theology, and arts; but the title of professor is frequently, and that of doctor occasionally, employed. At first the same confusion existed at Oxford, but during the fifteenth century the custom gradually prevailed in the English universities of limiting the use of the title “doctor” to the faculties of law, theology, and medicine. In Germany the title was known as early as the thirteenth century and for a long time very highly regarded; doctors were recognized, even by the Imperial law, as entitled to the privileges of nobility. But when the degree began to be carelessly conferred, they sank in the public estimation, until it was possible for a proclamation in Hesse-Cassel, 1762, to put them in the tenth class, with valets and the like. In France, also, while up to the Revolution the highest consideration attached to the title of Doctor of the Sorbonne (q.v.), that famous theological faculty which was called “the perpetual council of the Gallican church,” such was by no means the case with the degrees of the other schools of learning. Furetière, in his dictionary, defines a scholar as a man who learns, and a doctor as a man who forgets. In England the doctor's degree was not introduced

into the universities till the reign of John or Henry III. For a time it was a very rare and highly prized honor, and the ceremony of conferring it was attended with scenes of feasting and revelry, of which curious accounts will be found in Anthony à Wood, *History and Antiquities of the University of Oxford* (London, 1792–96). In modern times the title of doctor has been applied almost everywhere to the three faculties of theology, law, and medicine. In America and Germany it extends to that of philosophy, and in the latter country the degree of “doctor of philosophy and master of arts” is conferred, as if the two were equivalent. Oxford and Cambridge, and in modern times some of the German and American universities, also create doctors of music. The doctor's degree is, in general, conferred at the instance of the dean of the faculty to which it appertains. It is granted on examination, or after at least the ancient form of publicly defending a learned thesis in Latin has been observed; or else it is an honorary degree, conferred in consideration of the general reputation of the recipient for eminence in some particular branch of learning, or occasionally on account of some other distinction. The musical degree in the English universities, which is equivalent to the master's degree in other faculties, there being no degree of master of music, is given only after approval of a cantata composed by the candidate and performed at his expense. Consult: Rashdall, *Universities of Europe in the Middle Ages* (Oxford, 1895); Denifle, *Die Universitäten des Mittelalters bis 1400* (Berlin, 1885); and the authorities referred to under UNIVERSITY and DEGREE. For professional uses of the degree of D.C.L., see DOCTORS' COMMONS.

**DOCTOR, THE.** A romance by Robert Southey, first issued anonymously (1834).

**DOCTOR AND STUDENT.** The title of a celebrated little book on the common law, which made its appearance in the reign of Henry VIII, probably about 1530. It is attributed to one Christopher Saint-Germain, a barrister of the Inner Temple, about whom nothing definite is known. The work was originally composed in Latin and is cast in the form of a dialogue between a doctor of divinity and a very learned “student” of the common law, the latter instructing the former in a somewhat didactic manner in the mysteries of his system. It contains some suggestive discussion of legal principles, common-law doctrine being sometimes effectively contrasted with the doctrine of the civil law, usually to the advantage of the latter. The book contrasts the doctrine of consideration in contracts, which was then beginning to take form in the English legal system, with the Roman law doctrine of *causa* and throws a good deal of light upon the former. The work is a mere fragment, however, and though it has enjoyed a considerable reputation it never rose to the rank of a legal authority. It appears to have taken on its present English form in the lifetime of the author, being, perhaps, translated by his own hand. It has passed through many editions, the best being the eighteenth, by Muchall, published in Dublin in 1792, and republished in Cincinnati in 1874.

**DOCTOR FISH.** See SURGEON FISH.

**DOCTOR JEKYLL.** See STRANGE CASE OF DR. JEKYLL AND MR. HYDE.

**DOCTORS' COMMONS.** A name applied both to the association of doctors of the civil

and canon law in London, practicing by exclusive privilege in the ecclesiastical courts, and to a building erected by them about 1567 near St. Paul's for the accommodation of those courts and the Court of Admiralty. The doctors were divided into two classes—advocates and proctors—corresponding to attorneys and solicitors, and were headed by a president, the dean of arches for the time being. Admission to practice was granted to a D.C.L. of Cambridge or of Oxford by the decree of the archbishop, after an elaborate ceremony. The college was dissolved in 1857 and the property sold, the proctors being given privileges of solicitors and receiving compensation, and solicitors being allowed to act as proctors. The principal ecclesiastical court comprised in the Doctors' Commons was the Court of Arches, the appellate court of the Archbishop of Canterbury, presided over by the dean of arches, with original jurisdiction in all ecclesiastical cases in the Province of Canterbury, and also in cases raised by letters of request. (See LETTER.) Divorces were formerly tried here, but are now tried by the Divorce Court. The other courts have in the main suffered the same fate. They comprised the Archdeacon's Court, for ecclesiastical cases in the archdeaconry; the Prerogative Court, with certain probate jurisdiction (now transferred to the Probate Court); the Faculty Court, for the granting of dispensations; and the Court of Delegates, in cases of ecclesiastical appeals (now transferred to the judicial committee of the Privy Council). The buildings as well as the organization of the Doctors' Commons have disappeared, the courts have been amalgamated with others, the officials have lost their special privilege, but the old names remain, and will probably die out but slowly. For the statutes of the changes in the old arrangement, see 21 Vict., c. 77; 21 and 22 Vict., cc. 95, 108; 23 and 24 Vict., c. 27; 33 and 34 Vict., c. 28, s. 30; 40 and 41 Vict., c. 25, s. 17. Consult also Stow, *Survey of London* (London, 1598). See ARCHES, COURT OF; ATTORNEY; BARRISTER; SOLICITOR.

**DOCTORS OF THE CHURCH.** A title long current for the most eminent of the early Christian teachers, and applied especially to the four Greek fathers—Athanasius, Basil, Gregory Nazianzen, and Chrysostom—and the four Latin fathers—Ambrose, and Gregory. In recent times the title has been formally conferred by the Pope on saints eminent for theological learning, some as modern as St. Alphonsus Liguori (died 1787). In the Middle Ages the name of doctor was freely applied to the leading theologians, with some additional expression characterizing the peculiar gift of the writer designated.

The following alphabetical list of such affixes is taken from Wetzer and Welte, *Kirchenlexikon*, 2d ed. by Kaulen (Freiburg, 1882-1900). The date is that of death, and the contractions are as follows:

O. Carn.	= Carmelite	O. Præm.	= Præmonstratensian.
O. Carth.	= Carthusian.	O.S.A.	= Augustinian.
O. Cist.	= Cistercian.	O.S.B.	= Benedictine.
O.M.	= Minorite or Franciscan.	O. Trin.	= Trinitarian.
O.P.	= Dominican.	S.J.	= Jesuit.

Doctor abstractionum, acutus et illuminatissimus—Francis of Mayroni, 1325 or 1327.  
—acutissimus—Francis della Rovere (Pope Sixtus IV), 1484.

Doctor abstractionum, acutus—Gabriel Vasquez, S.J., 1604.  
—admirabilis (mirabilis)—Roger Bacon, O.M., 1294.  
—amēnus—Robert of Cownton, O.M., about 1340.  
—angelicus, communis, or cherubicus—St. Thomas Aquinas, O.P., 1274.  
—authenticus—Gregory of Rimini, O.S.A., 1358.  
—authoratus, copiosus, fundatissimus et solidus—Richard of Middleton, O.M., about 1300.  
—beatus et fundatissimus—Giles Colonna, O.S.A., 1316.  
—bonus—Walter Brinkelius, O.M., about 1310.  
—Christianissimus—John Charlier of Gerson, 1429.  
—Christianus—Nicholas of Cusa, 1464.  
—clarus—Louis de Montesinos, 1621.  
—clarus et subtilis—Dionysius junior, O.Cist., fifteenth century.  
—collectivus—Landolfo Caracciolo, O.M., 1351.  
—columna doctorum—William of Champeaux, O.S.B., 1121.  
—communis—St. Thomas Aquinas, O.P., 1274.  
—conspicuus et planus—Walter Burley, after 1337.  
—contradictionum—John Wessel, 1489.  
—divinus, ecstasticus—John of Ruysbroeck, 1381.  
—doctorum—Anselm of Laon, 1117.  
—dulcifluus—Antony Andrea, O.M., about 1320.  
—ecclesiæ—St. Thomas Aquinas, O.P., 1274.  
—ecstasticus—Dionysius of Rickel, O.Carth., 1471.  
—elegans et facundus—Peter Aureoli, O.M., 1322.  
—eminens—St. John of Matha, O.Trin., 1213.  
—excellentissimus—Antony Corsetti, 1503.  
—eximius—John Tisserius, O.M., about 1564, and Francis Suarez, S.J., 1617.  
—famosissimus—Peter Alberti, O.S.B., about 1426.  
—famosus—Bertrand de la Tour, O.M., 1334.  
—fundamentalis, subtilis et perspicacissimus—John Faber of Bordeaux, about 1350.  
—fundatus—William Verus (de Waria), O.M., about 1270.  
—illibatus—Alexander Alamannicus, O.M., fifteenth century.  
—illuminatus—Raymund Lulli, O.M., 1315.  
—illuminatus et sublimis—John Tauler, O.P., 1361.  
—illustratus—Francis Picenus, O.M., fourteenth century.  
—illustris or illustratus—Adam of Marisco, O.M., about 1380.  
—inclytus—William Mackelfield, O.P., about 1300.  
—ingeniosissimus—Andrew of Neufchâteau, O.M., about 1300.  
—invincibilis—Peter Thomas, O.M., fourteenth century (?).  
—invincibilis et singularis—William of Occam, O.M., 1349.  
—irrefragabilis, fons vitæ, monarcha theologorum—Alexander of Hales, O.M., 1245.  
—magnus—Albertus—O.P., 1280.  
—magnus, universalis—Alan of Ryssel, O.Cist., 1202.  
—marianus—St. Anselm of Canterbury, 1109, and John Duns Scotus, O.M., 1308.  
—mellifluus—St. Bernard, O.Cist., 1153.  
—mellifluus alter—Ælred, O.Cist., 1166.  
—mirabilis—Antony Perez, S.J., 1649, and Roger Bacon, O.M.  
—moralis—Gerhard Eudo, O.M., 1349.  
—notabilis—Peter of Ryssel, O.M.



- Doctor abstractionum, ordinatissimus or ornatissimus—John of Bassoli, O.M., about 1347.  
 —ornatissimus et sufficiens—Peter of Aquila, O.M., about 1344.  
 —pacificus et proficius (profitabilis)—Nicholas Bonet, O.M., 1360.  
 —planus et utilis—Nicholas of Lyra, O.M., 1341.  
 —præclarus—Peter of Kaiserslautern, O.Prem., about 1330.  
 —præstantissimus—Thomas Netter of Walden, O.Carm., 1431.  
 —profundissimus—Paul of Venice, O.S.A., 1428; Gabriel Biel, 1495; John Alphonsus Curiel, O.S.B., 1609.  
 —profundus—Thomas of Bradwardine, 1349.  
 —refulgidus—Peter Philargi (Pope Alexander V), 1410.  
 —resolutissimus—William Durand of Saint-Pourçain, O.P., 1332.  
 —resolutus, princeps Averroistarum—John Bacon, O.Carm., 1346.  
 —scholasticus—Peter Abélard, 1142; Gilbert de la Porrée, 1154; Peter Lombard, 1164; Peter of Poitiers, 1205; and Hugh of Castro Novo, O.M., after 1322.  
 —seraphicus—St. Bonaventura, O.M., 1274; sometimes also St. Francis of Assisi, O.M., 1226.  
 —solemnis—Henry Goethals of Ghent, 1293.  
 —speculativus—James of Viterbo, O.S.A., 1308.  
 —sublimis—Francis of Bachepe, O.Carm., 1372, and John Courtecuisse, about 1425.  
 —subtilis—John Duns Scotus, O.M., 1308.  
 —subtilissimus—Peter of Mantua, fourteenth century (?).  
 —succinctus—Francis of Ascoli, O.M., about 1340.  
 —summus doctorum—Peter of Belle-Perche, 1308.  
 —universalis—Albert the Great, O.M., 1280.  
 —venerandus—Walfried de Fontibus, O.M., after 1240.

**DOCTOR'S TALE, THE.** A story contained in Chaucer's *Canterbury Tales*, supposed to be narrated by a doctor of physic, and consisting of an English version of the Roman legend concerning Appius and Virginia, as recounted in the *Roman de la Rose*.

**DOCTOR SYNTAX.** See COMBE, WILLIAM.

**DOCTRINAIRE**, dôk'trénâr' (Fr., theorist, from Lat. *doctrina*, doctrine). A term used to designate one who is an advocate of principles and of practical schemes in government and politics. After the first restoration of the Bourbons, in 1815, the term came to be applied in France to a portion of the parliamentary opposition which urged the adoption of a plan of government somewhat similar to the English system of a limited monarchy with parliamentary control. For these views they were ridiculed by Republicans and Monarchists and called *doctrinaires*. Mounier, Lally-Tollendal, Clermont-Tonnerre, Talleyrand, and the Abbé Montesquieu were the true fathers of the party. They had their rallying point in the salons of the Duc de Broglie, and were led in the Chamber by Royer-Collard and supported in the press by Guizot, Villemain, Barante, and the younger members of what afterward became the Orleans party. The development of the constitution on the basis of the *charte* of Louis XVIII was their watchword, but their real inspiration was derived from England. When the revolution of 1830 occurred, they became the advisers and ministers of Louis-Philippe, and were more deeply

imbued with the principles of constitutional monarchy than any other political party that has ever existed in France. The revolution of 1848 did away with the doctrinaires as a political party exerting an influence on the government, and the term ceased to be used save historically or in an abstract sense. Consult: Thureau-Dangin, *Le parti libéral sous la Restauration* (Paris, 1876), and the memoirs of Guizot (2 vols., ib., 1858-68), Barante (ib., 1890), and Duc de Broglie (ib., 1886). There is an English translation of Guizot's *Mémoires*, under the title of *Memoirs to Illustrate the History of my Own Time* (4 vols., London, 1858).

**DOCTRINE.** See DOGMA.

**DOCTRINE, FATHERS OF CHRISTIAN, or DOCTRINARIANS.** A clerical brotherhood in the Roman Catholic church. It was founded by César de Bus (1544-1607), who after a military career, turning to piety, was ordained in 1582 and became zealous in all good works. Devoting himself especially to opposing the progress of the Huguenots in France in 1592, he joined with Romillon, a canon of Isle, who was a convert from Calvinism, Pinelli, a canon of Vigevano, and two others to form a congregation of secular priests for the purpose of teaching Christian doctrine to the ignorant. It was confirmed by Clement VIII in 1597, and the founder, resigning his canonry, became its first superior. He left a reputation for great sanctity and was declared venerable by Pius VII in 1821. His successor, Father Vignier, after founding several daughter houses, sought to make the brotherhood a regular congregation with solemn vows. Pope Paul V confirmed this on condition that they should unite with some existing congregation. In 1616, accordingly, the congregation, in connection with the Italian congregation of Somasco, founded by St. Jerome Emiliani; but a few members, not feeling bound to make the solemn vows, joined the French Oratorians. The connection was dissolved by Innocent X in 1647, and Alexander VII allowed the *Doctrinaires* (as they are called in France) to make the simple vows, with the addition of that of perseverance. Under the new system they spread into Italy. After great difficulties from the French Revolution, and internal dissensions which ended in Pius VII suppressing them in 1805 against any vows for the future, they have since made themselves useful in the nineteenth century, especially in schools and diocesan seminaries, and at the present time have about 600 members. De Bus also founded an order for women, called Daughters of Christian Doctrine, which later became the French Ursulines.

**DÓCZI**, dô'tsé, LUDWIG VON (1845- ). An Hungarian publicist and author, born at Odenburg. He was educated in Vienna and Budapest, was for a time a journalist, in 1867 became an official in the Austro-Hungarian Ministry of the Interior, and later a counselor in that of Foreign Affairs. His publications include the dramas *Utolsó próféta* (1868) and *A Csók*, 'The Kiss' (1871), several works in pro-c. fiction, and poems. He also made some translations into Hungarian, in particular of the first part of Goethe's *Faust* (new ed., 1878) and of Schiller's poems (1903-05).

**DOD, DANIEL** (1788-1823). An American mechanic, born in Virginia. He was educated at Rutgers College and became one of the most successful engine-builders in the United States.



He constructed the engine for the *Savannah*, the first steamer that ever crossed the Atlantic. He was killed by a boiler explosion at New York City.

**DODD, FRANK HOWARD** (1844- ). An American publisher, son of Moses Woodruff Dodd. He was born at Bloomfield, N. J. In 1870, with Edward S. Mead, he succeeded to the business of his father, under the firm name of Dodd and Mead, the establishment becoming, with the admission of Bleecker Van Wagenen in 1876, Dodd, Mead and Company. Afterward he became the active head of the firm and was instrumental in establishing the *Bookman* in 1895, the *NEW INTERNATIONAL ENCYCLOPÆDIA* (1902; 2d ed., 1914-15), and other important enterprises. He was elected a vice president of the American Publishers' Association. As book-sellers, the firm became one of the leading authorities upon and dealers in rare books. It has published the works of many distinguished writers in all branches of literature.

**DODD, MOSES WOODRUFF** (1813-99). An American publisher, born at Bloomfield, N. J. After graduation at Princeton in 1837, he entered the Princeton Theological Seminary, but was soon obliged by ill health to relinquish his studies for the ministry and in 1839 formed a partnership with John S. Taylor, then a leading publisher of New York. Mr. Taylor having withdrawn in 1840, he continued the business—subsequently to be known as Dodd, Mead and Company—under the style of M. W. Dodd until his retirement in 1870. The publications of the house during this period were chiefly theological and classical.

**DODD, WALTER FAIRLEIGH** (1880- ). An American university professor and writer on political science, born in Hopkinsville, Ky. He graduated from Florida State College in 1898 and gained his Ph.D. at the University of Chicago; had charge of the section of foreign law in the library of Congress (1904-07); held a research appointment at Johns Hopkins University (1908-10); and was first an associate in political science (1910-11), and then assistant professor at the University of Illinois. He became one of the editors of the *American Political Science Review*. Besides contributions to legal and technical journals he is author of *Modern Constitutions* (2 vols., 1909); *Government of the District of Columbia* (1909); *Revision and Amendment of State Constitutions* (1910).

**DODD, WILLIAM** (1729-77). An English clergyman and man of letters. He was born at Bourne, in Lincolnshire, graduated at Clare Hall, Cambridge, in 1750, and was ordained in London, where he became a popular preacher. In 1763 he was appointed King's chaplain; tutor to Philip Stanhope, the fifth Earl of Chesterfield. For attempting to gain preferment by bribery in 1774 he was removed from the list of king's chaplains, and he lived abroad for two years. His extravagances led him in after life to forge the signature of his former pupil, the Earl of Chesterfield, for £4200; he was tried, convicted, and executed, in spite of the efforts of his friend, Dr. Johnson. Among his numerous writings are: *Beauties of Shakespeare* (1752), which supplied Goethe with his first knowledge of the poet; *Reflections on Death* (1763); a *Commentary on the Bible* (1765-70); and a poem, *Thoughts in Prison* (1777). Consult Fitzgerald, *A Famous Forgery* (London, 1865).

**DODDER** (*AS. dodder*, probably connected,

as being a yellow plant, with *AS. dydrin*, OSax. *dodro*, OHG. *totoro*, yolk of an egg), *Cuscuta*. A genus of plants referred by some botanists to the family Convolvulaceæ, and regarded by others as the type of a small distinct family, Cuscutaceæ. The plants are leafless, climbing parasites, with flowers in dense clusters; have scales on the tube of the corolla alternate with its segments, and a spiral threadlike embryo, lying in a mass of fleshy albumen. There are about 100 known species of *Cuscuta*, chiefly found in the warmer temperate parts of the globe, about 20 occurring in the United States. The name "dodder" is often extended to all of them. One or two species of *Cuscuta* are natives of Great Britain, parasitic on leguminous plants, heath, thyme, hops, nettles, etc. A species of dodder, *Cuscuta epilinum*, is very injurious to crops of flax in Germany, and leguminous crops often suffer from *Cuscuta epithymum* in the south of Europe and elsewhere. Some of these species have been introduced in clover and alfalfa seed from Europe and are fast becoming serious pests of clover and alfalfa fields. Only clean seed should be sown, and where dodder has become established the crop should be cut and burned before the dodder seeds mature. It usually appears first in isolated patches, the spreading of which may be prevented by careful attention. The seeds are slightly smaller than clover seed and may be screened out if care be given the operation. The seed of dodder germinates in the ground, but the stem soon seeks to attach itself to plants by little rootlets (haustoria) which it sends out, and the original root dies. The appearance of dodder has been described as resembling "fine, closely tangled, wet catgut." For illustration, see Plate of PARASITIC PLANTS.

**DODD'RIDGE, PHILIP** (1702-51). An English Nonconformist clergyman and writer. He was born in London and was educated for the ministry at Kibworth, in Leicestershire, where he became pastor of a Baptist congregation. In 1729 he received a call to the ministry and became president of the theological academy there (now New College, Hampstead). He formed a society for the distribution of Bibles among the poor and submitted to his denomination what was probably the first project for foreign missions among the Nonconformists. His principal works are: *The Rise and Progress of Religion in the World* (1745), which has been translated into many languages; *The Family Expositor* (1730-56); and his *Course of Lectures*, delivered to the students under his charge and published by the Rev. Samuel Clarke (1763). Many of his hymns are still sung, including "O God of Bethel, by whose hand," "Awake, my soul, stretch every nerve," "O happy day, that fixed my choice," "Hark, the glad sound, the Saviour comes," and "How gentle God's commands." He improved Jeremiah Rich's system of shorthand. Consult *The Correspondence and Diary of Philip Doddridge*, ed. by his great-grandson, John Doddridge Humphreys (London, 1820-31), and the biography (1880) by Stanford.

**DODDS, WILLIAM** (1874- ). An American editor, born in Allegheny, Pa. After graduating from Duffs College (Pittsburgh, Pa.) in 1890, he engaged in news writing and editorial work. He was associate publisher of *The Builder*, Pittsburgh (1894-96), night editor of the *Pittsburgh Dispatch* (1902), associate publisher of the *Telegraph*, Sharon, Pa. (1902-04), and night editor of the *Gazette Times*, Pitts-

burgh (1905-08). In 1908 he became managing editor of the *Christian Science Monitor*, Boston, and in 1909 vice president of the United Press Associations.

**DODECANESIA** (Greek for twelve islands). The name applied since the Turkish wars of 1912-13 to the group of islands occupied by Italian forces off the southwest coast of Asia Minor. The group constitutes the southern Sporades and consists, from north to south, of the islands (q.v.) of Patmos, Lipsos, Leros, Calymnos, Cos, Nisyros, Astropalia, Tilos, Symi, Rhodes, Carpathos, and Casos, besides a number of minor uninhabited islets. Sponge fishing is the principal occupation of the islanders, who are known as expert divers. Fruits and vegetables are also raised for export mainly to Egypt, but a certain quantity finds its way to the Anatolian coast. By far the large majority of the islanders are Greeks.

The islands are claimed by Greece. By the terms of the Treaty of Lausanne, which terminated the Turco-Italian war, Italy agreed to restore the islands to Turkey. The breaking out of the Balkan War, however, prevented this stipulation from being carried out. At the time of writing (April, 1914) all interested parties have agreed to let the European Powers decide jointly the fate of the islands.

**DODECASTYLE** (Gk. δώδεκα, *twelve* + στύλος, *column*). In classic architecture a term denoting a composition showing 12 columns in front or end elevation, as in the portico of the Chambre des Députés at Paris.

**DODEC'ATHE'ON**. See COWSLIP.

**DODE DE LA BRUNERIE**, dōd de là brun'è', GUILLAUME, VICOMTE (1775-1851). A French soldier, born at Saint-Geoire (Isère). He served in the engineer corps in the Rhenish, Egyptian, and Italian campaigns, distinguished himself at Rastadt, and in 1805 he became a colonel. He directed the siege operations at Saragossa in 1809, was promoted to be general of division in 1812, and maintained a magnificent defense of the fortress at Glogau in 1813. In 1823 he was commander of engineers in the Spanish campaign. In 1840 was appointed president of the commission on fortifications, and in 1840-45 completed the defenses of Paris. He received the marshal's baton in 1847—the first engineer since Vauban, it is said, to be thus honored.

**DÖDERLEIN**, dē'dēr-lin, LUDWIG (1791-1863). An eminent German classical scholar, born at Jena. He studied under Tiersch in Munich (1810-11), then two years in Heidelberg, and later in Erlangen and Berlin. In 1815 he became professor of classical philology in Bern, and in 1819 was called to Erlangen as rector of the gymnasium and professor of classical philology in the university. Here he remained until his death. Döderlein combined with accurate scholarship a rare enthusiasm and skill in teaching which had a most important influence on the schools and the teachers of Bavaria. His most important published works are: editions of Sophocles' *Œdipus Coloneus* (1825); *Tacitus* (1841-47); *Horace's Epistles* (1856-58); *Horace's Satires* (1860); *Iliad* (1863-64). He also wrote the following treatises: *Lateinische Synonymen und Etymologien* (6 vols., 1826-38); *Lateinische Wortbildung* (1838); *Handbuch der lateinischen Synonymik* (1839; 2d ed., 1849); *Handbuch der lateinischen Etymologie* (1841); *Homerisches Glossarium* (1850-58); *Reden und Aufsätze* (1860). Consult Bursian,

*Geschichte der klassischen Philologie in Deutschland*, vol. ii (Munich, 1883), and *Allgemeine deutsche Biographie*, vol. v (Leipzig, 1877).

**DODGE, CHARLES RICHARDS** (1847- ). An American expert on fibres and fibre industries. He was born in Mississippi and was educated at Sheffield Scientific School, Yale. He became associated with the United States Department of Agriculture in 1867, was for 10 years director of the Agricultural Museum, and in 1890 was appointed special agent in charge of fibre investigations for the Department of Agriculture. His *Dictionary of the Fibres and Fibre Plants of the World* (1897) is a work of considerable value, and he is also author of a number of pamphlets on fibres. He was a member of the jury of awards at a number of expositions.

**DODGE, CLEVELAND HOADLEY** (1860- ). An American merchant, son of William E. Dodge and brother of Grace H. Dodge, born in New York City. He graduated from Princeton University in 1879. He was chosen a director of a number of banks, insurance companies, and other corporations, became treasurer of the El Paso and Southwestern Railroad and vice president of Phelps, Dodge & Co., and served as vice president of the New York Chamber of Commerce. With Y. M. C. A. interests he actively identified himself, as president of the board of trustees of the New York association and as a member of the international committee; and he was elected president of the board of trustees of Robert College, Constantinople.

**DODGE, FRANCIS SAFFORD** (1842-1908). An American soldier, born in Danvers, Mass. He fought in the Civil War, reentered service as first lieutenant in the Ninth Cavalry (colored) in 1866, and in 1880 was transferred to the paymaster's department with the rank of major. Thereafter he was advanced through the grades to be paymaster general with the rank of brigadier general in 1904; he was retired in 1906. In 1870, with four troops of the Ninth Cavalry, he destroyed a large Indian camp in the Guadalupe Mountains; but his most famous exploit, of 1879, consisted of a voluntary 100-mile forced march with troop D of his regiment to the relief of Major Thomas T. Thornburg, whose small force near Mill Creek, western Colorado, the Indians threatened to annihilate. Fighting their way through the Indians, Dodge and his men joined Thornburg in his rifle pits and helped to hold the enemy at bay until reinforcements arrived. For this feat, one of the most brilliant in Indian warfare, Dodge was awarded the congressional medal of honor and brevetted major in 1880.

**DODGE, GRACE HOADLEY**. An American leader in Y. W. C. A. and other religious, social, and educational work. She was born in New York City, a daughter of William E. Dodge and sister of Cleveland H. Dodge. Actively interested during more than 30 years in plans for social betterment (especially in increasing opportunities for self-supporting girls and young women), and having at her command part of her father's large fortune, she was called to many positions of service. At various times she was a member of the New York City school board, treasurer of Teachers College (Columbia University), and president of the Working Girls' Society. She built a chain of hotels for working girls and through personal influence and quiet but notable generosity accomplished the unification and

assured success of the Young Women's Christian Associations of the United States—this was her great work. She was elected president of the national board of the Y. W. C. A. and became a member of the world's committee. In 1912-13 she gave \$350,000 for the national board and metropolitan association buildings in New York City. Miss Dodge edited *Thoughts of Busy Girls* (1892), wrote *A Bundle of Letters to Busy Girls on Practical Matters* (1897; trans. into several foreign languages), and is co-author of *What Women Can Earn* (1899).

**DODGE, GREENVILLE MELLE** (1831- ). An American soldier and civil engineer. He was born at Danvers, Mass., and was educated at Norwich University, Vt. He was a member of the government survey along the Platte, one of the first surveys for a railway to the Pacific. He fought throughout the Civil War and rose to the rank of major general of United States volunteers. In 1864 he commanded the Sixteenth Corps of General Sherman's army in the campaign before Atlanta (May to September) and subsequently succeeded Rosecrans as commander of the Department of Missouri. In 1866-70 he was chief engineer of the Union Pacific and in 1871-81 of the Texas and Pacific Railway. From 1867 to 1869 he served as a member of Congress (Republican) from Iowa, and in 1898 was made president of the commission appointed to investigate the charges of mismanagement relative to the Spanish-American War.

**DODGE, JACOB RICHARDS** (1823-1902). An American agricultural statistician, born at New Boston, N. H. He received an academic and technical education. After teaching in Mississippi (1845-49) and editing a paper at Nashua, N. H. (1850-54), he was editor of the *American Ruralist* at Cincinnati, Ohio, in 1857-61. For 24 years he was chief of the reports of the United States Department of Agriculture, and he also contributed to the agricultural press and to the tenth census and wrote pamphlets on rural economics. He had charge of foreign commissions for the Department of Agriculture in 1873 and in 1887, and in 1893 joined the editorial staff of the *Country Gentleman*. His publications include: *Red Men of the Ohio Valley* (1860); *West Virginia: Its Farms and Forests, Mines and Oil-Wells* (1865); *Farm and Factory* (1884).

**DODGE, JAMES MAPES** (1852- ). An American mechanical engineer, born at Waverly, N. J. He was educated at Cornell University and at Rutgers College. His important work was in connection with the improvement of conveying machinery and appliances. Settling in Philadelphia, he became chairman of the Link Belt Company and president of the Dodge Coal Storage Company and of the J. M. Dodge Company. He was at one time vice president of Franklin Institute, and in 1903 he was president of the American Society of Mechanical Engineers. His address on *The Money Value of Technical Education Training* was published in 1903.

**DODGE, MARY ABIGAIL** (c.1830-96). An American writer, known as "Gail Hamilton," born at Hamilton, Mass. She was an editor of *Our Young Folks*, Boston (1865-67). Her writings were aggressive, brilliant, and popular, though in the main ephemeral. She wrote: *Gala Days* (1863); *Red Letter Days in Applethorpe* (1866); *Woman's Wrongs* (1868); *The*

*Battle of the Books* (1870); *Woman's Worth and Worthlessness* (1872); *Sermons to the Clergy* (1875); *Our Common School System* (1880); *The Irrepressible Book* (1885); *James G. Blaine* (1895); *Chips, Fragments and Vestiges* (1902), Ed. by H. A. Dodge. Her pen name was Gail Hamilton, the former word being the last syllable of Abigail, the latter her birthplace. Consult H. A. Dodge, *Gail Hamilton's Life in Letters* (2 vols., 1901).

**DODGE, MARY ELIZABETH MAPES** (1838-1905). An American editor, poet, and juvenile writer, a daughter of Prof. James J. Mapes. She was born and educated in New York and became the wife of William Dodge, a lawyer of that city, but was soon left a widow. She began literary work on the staff of *Hearth and Home* and in 1873 became editor of *St. Nicholas*, the juvenile magazine, which under her direction came to occupy a field practically undisputed in the United States. A frequent contributor to other periodicals, she also wrote several volumes of juvenile verse and prose, of which the more noteworthy are *Hans Brinker; or, The Silver Skates* (1865; a new illustrated ed., 1913; translated into five European languages and crowned by the French Academy); *Theophilus and Others* (1876); *Donald and Dorothy* (1883); *The Land of Pluck* (1894); *The Golden Gate* (1903). She also published collections of poems: *Along the Way* (1886); *When Life is Young* (1894); *Poems and Verses* (1904).

**DODGE, RICHARD ELWOOD** (1868- ). An American geologist, born at Wenham, Mass. He was educated at Harvard University in 1890 and taught geology there for four years; taught at Teachers College (Columbia University), where he became professor of geology in 1897; and was also an assistant geologist of the United States Geological Survey (1890-95). In 1899 he became associate editor of the *Bulletin of the American Geographical Society*, and he was editor of the *Journal of School Geography* (1897-1901), the *Journal of Geography* (1902-10), and of the *Annals of the Association of American Geographers*. Besides many articles on the teaching of geography and on the southwestern part of the United States as the home of ancient peoples, he is also author of *Reader in Physical Geography for Beginners* (1900); *Geography in the Horace Mann Schools* (1901); *The Teaching of Geography in Elementary Schools* (1913), with C. C. Kirckwey; and a series of textbooks on geography.

**DODGE, THEODORE AYRAULT** (1842-1909). An American soldier and military historian. He was born in Pittsfield, Mass., and was educated abroad, studying military science in Berlin under General Von Frohreich of the Prussian army and graduating at the University of London in 1861. He then returned to the United States, enlisted as a private in the Federal army, lost a leg at Gettysburg, and rose to the rank of major in the Veteran Reserve Corps in 1864. He was brevetted colonel of Volunteers in December, 1865, was appointed captain in the regular service in July, 1866, was brevetted lieutenant colonel in the regular army in 1867, and served as chief of the bureau of enrollment in the War Department until 1870, when he was retired. He is best known as a military historian and critic, and his *Bird's Eye View of our Civil War* (1883; later ed., 1897) is perhaps the best brief popular account

of the war of 1861-65. His *Campaign of* (1881) has also been highly commended. Besides many articles for the magazines, he has also published: *Patroclus and Penelope: A Chat in the Saddle* (1883); *Great Captains* (1886); *Riders of Many Lands* (1893); *Alexander* (1890); *Hannibal* (1893); *Cæsar* (1892); *Gustavus Adolphus* (2 vols., 1890-95); *Napoleon* (1904), the last five works forming part of a projected history of the art of war, to be completed in six volumes.

**DODGE, WILLIAM EARL** (1805-83). An American merchant and philanthropist. He was born in Hartford, Conn., was educated in the public schools, and worked for a short time in his father's cotton mill near Norwich. Removing to New York with his father, he entered a wholesale dry-goods store, and finally, after eight years, went into business by himself. In 1833 he became a member of the firm of Phelps, Dodge & Co. He became interested in railroad and insurance corporations and invested largely in mines and woodlands. He was interested in temperance and religious work and was one of the most generous supporters of the Young Men's Christian Association and the Freedmen's Bureau. He was a member of the Peace Convention of 1861 and was a Republican member of Congress in 1866. President Grant appointed him a member of the Indian Commission. At his death he left bequests to religious and charitable institutions. Consult Martin, *William E. Dodge, the Christian Merchant* (New York, 1890).

**DODGE CITY.** A city and the county seat of Ford Co., Kans., 126 miles west of Hutchinson, on the Arkansas River, and on the Atchison, Topeka, and Santa Fe and the Chicago, Rock Island, and Pacific railroads (Map: Kansas, C 7). The city contains St. Mary's of the Plains Academy (Roman Catholic), United States Land Office and Weather Bureau buildings, and a Carnegie library. Dodge City has division offices and machine shops of the Santa Fe railroad and is the centre of a stock-raising and wheat-growing district. In the seventies it was famous in the West as a lawless Texas cattle-shipping point. It owns its water works and has adopted the commission form of government. Pop., 1900, 1942; 1910, 3214. Consult R. M. ... *Dodge City, the Cowboy Capital*.

**DODGEVILLE.** A city and the county seat of Iowa Co., Wis., 47 miles west by south of Madison, on the Chicago and Northwestern and the Illinois Central railroads (Map: Wisconsin, C 6). Deposits of lead and zinc occur in the vicinity, and the city has considerable trade in live stock and ... products. The manufacture of ... is the chief industry. Dodgeville was the early home of Territorial Governor Dodge, for whom it is named. Pop., 1900, 1865; 1910, 1791.

**DODGSON, dōj'son, CHARLES LUTWIDGE** (1832-98). An English author, best known by his pseudonym, LEWIS CARROLL. He was born in the village of Daresbury, near Warrington (Chester), England. Educated at Oxford, he took deacon's orders in 1861, and from 1855 to 1881 he was mathematical lecturer at Christ Church. He was an acute mathematician, with a penchant for the intricate and ingenious, and made to mathematical literature a contribution of high rank in his *Euclid and his Modern Rivals* (1879), eccentrically cast in dramatic mold and interspersed with jokes. His mathematical pub-

lications include a *Syllabus of Plane Algebraical Geometry* (1860) and *An Elementary Treatise on Determinants* (1867). But he is best known as the originator of an unique literary genre in his *Alice's Adventures in Wonderland* (1865), with its continuation in *Through the Looking-Glass and What Alice Found There* (1871), both admirably illustrated by Sir John Tenniel. These books display a delightful combination of mad absurdity and subtle fancy. Their grotesque situations compose a peculiar literary tradition. *The Hunting of the Snark* (1876), an episode none the less enjoyable because its meaning remains unsolved, was nearly as successful. *Sylvie and Bruno* (1889) and *Sylvie and Bruno Concluded* (1893) were inferior to the previous works. A dramatization of the Alice volumes by Saville Clarke was presented in London in 1886. For a full account of Dodgson's interesting personality, consult the *Life and Letters*, ed. by Collingwood (London, 1898), and for a brief account, B. Moses, *Lewis Carroll* (New York, 1910).

**DODDINGTON, GEORGE BUBB, BARON MELCOMBE** (1691-1762). An English politician. He was the son of Jeremiah Bubb, but took the name of Doddington in 1720, on inheriting a large estate from an uncle of that name. He studied at Oxford, was elected member of Parliament for Winchelsea in 1715, and from 1715 to 1717 was envoy extraordinary to Spain. He became very wealthy, controlled five or six votes in Parliament, and had an inordinate desire to become a power in politics and to be elevated to the peerage, and bartered away his votes first to one party and then to another. He was first a follower of Walpole, deserted to the Prince of Wales, and was later allied in turn to Argyll, Henry Pelham, Newcastle, and Bute. His variability and the venality of his half-dozen votes made him the frequent butt of political satire and caricature. He was a lord of the treasury from 1724 to 1740, became treasurer of the navy under Henry Pelham in 1744, and in 1755 held the same position under the Newcastle-Fox coalition. For his support of Lord Bute in 1761 he was rewarded by being created Baron Melcombe of Melcombe Regis, Dorsetshire. Doddington was one of the last of the "patrons" and gathered about him some of the best-known literary men of the time, including Young, Thomson, and Fielding. His *Diary*, published in 1784, is an interesting picture of the political and social life of the times.

**DODO** (Neo-Lat. *didus*, Port. *doudo*, simpleton, possibly connected with Devonshire, Eng. *dold*, dolt, lit. dulled, from *dull*), or **DRONTE** (Dutch, of unknown origin, bloated). An extinct specialized pigeon, of which we have knowledge of two species, the Mauritius dodo (*Didus cucullatus*), confined to the island of that name, and the Réunion dodo (*Didus solitarius*) of the island of Bourbon or Réunion. These birds, with the solitaire (*Pezophaps*), represent the family Dididae. They became extinct towards the end of the seventeenth century. It is described by several voyagers of the sixteenth and seventeenth centuries, who also spoke of it as "walghvogel" and "dronte," and seems even to have been brought alive to Europe. The descriptions of those who saw it are confirmed by several more or less rude drawings preserved in various European libraries and museums, especially in Holland. These represent a bird larger than a swan; of a very heavy and clumsy

not written before the beginning of the second century B.C.

**DOFFER** (from *doff*, ME. *doffe*, from *do* + *off*). That part of a carding machine which takes the sliver wool or cotton from the cylinder when carded. The invention of the doffer was claimed by both Arkwright and Hargreaves. See **CARDING**.

**DOG** (AS. *doega*). A carnivorous mammal of the family Canidae, especially the genus *Canis*, and more specifically one that is domesticated. The dog, or dogs, considered as a subject for present purposes, requires treatment from several points of view, viz.:

1. As a tribe, in its zoölogical relations.
2. As a more limited group, according to the ordinary acceptation of the term "dog."
3. As to the relation of domestic dogs to mankind.

The dog tribe includes the whole of the carnivorous family Canidae, for the zoölogical history and character of which see CANIDÆ. It embraces a variety of forms which are divisible into at least five groups:

- (a) The long-eared fox dog (*Otocyon*) of South Africa, which is the most generalized member of the family. See **FOX DOG**; **OTOCYON**.
- (b) The bush dog (*Icticyon*) of South America, a specialized aberrant form. See **BUSH DOG**.
- (c) The foxes, forming what Huxley called the alopecoid or vulpine series, and embracing the typical foxes, fennecs, corsacs, kit foxes, etc. See **FOX**; **FENNEC**; **ETC.**
- (d) The hunting dog (*Lycaon*) of South Africa. See **HUNTING DOG**.
- (e) The wolves, forming Huxley's thooid or lupine series, in which are found the wolves, jackals, fox dogs, crab-eating dog, and similar wild and domestic dogs of the world.

The first four of these subjects are treated of elsewhere, as indicated by the cross references noted above. In the last group (e), wolves, jackals, fox dogs, etc., many of the individual forms are separately described under their names. There remain then for consideration here: (1) a group which may properly be designated wild dogs, and (2) the domestic dogs.

**Wild Dogs.** There exist in southeastern Asia and in Australia three or four species of canine animals which are hardly separable from the genus *Canis* by distinct characters of importance, yet which seem to form a natural group that may be consistently separated as a genus or subgenus *Canis*, characterized mainly by the lack of the small last tubercular molar tooth on each side of the lower jaw (as was the case with fossil *Cynodictis*), by having a comparatively short muzzle, slightly convex facial outline, rather short legs, with long hair between the footpads, and 12 to 14 mammae instead of the normal 10. The dingo may, for the present, be included in this group. Their resemblance in general is to jackals, of which Huxley considers them a locally modified type, but they have a more "doggy" appearance than either jackals or wolves. It is from this resemblance that the designation "wild dogs" arises, and not from the belief that any of them is a direct progenitor of modern domestic dogs, even though individuals of all of them may occasionally have been tamed and attached to human owners. There is much general resemblance among them. In size they somewhat exceed the jackals, being from 30 to 38 inches long exclusive of the tail, which in all is long (about

two-fifths of the length of the body) and bushy, like that of a jackal or a fox. All have comparatively long and coarse hair, the prevailing color of which is rust red in summer and lighter in winter, and generally decidedly darker on the back and tail than on the chest, belly, and inside of the legs. They go abroad in the daytime rather more than at night, hunt in packs of a dozen or more, led by an old male, and dwell by families, sometimes in crevices of rocks, hollow trees, and similar retreats, but they do not dig burrows.

The best known of these is the Indian wild dog (*Canis*, or *Cyon*, *deccanensis*), which inhabits the forested parts of the whole Himalayan region, the treeless area of eastern Tibet, and southward as far as the great forests of India. The more southerly form, known as the *dhole* in the far south of the peninsula, *sona kuta* (golden dog) in central India, and *kolsun* among the Mahrattas, has been set apart by some students (see Mivart, *Proceedings of the Zoölogical Society of London*, 1890, p. 88) as a separate species (*Canis primævus*), but the distinction is much doubted. The native name of the northern form is "buansu," to which the reader is referred for further particulars.

The Malay wild dog (*Canis rutilans*) is a rather smaller species, which occurs east of Bengal throughout the Malay Peninsula and also in Java, Sumatra, and perhaps Borneo. Whether the wild dog of Upper Burma belongs to this or the preceding species is dubious, and this doubt lends color to the opinion of some naturalists that these Eastern forms are not specifically separate from the Indian one. Blanford regards the Malay dog as distinct and describes it as smaller, more slender in body and limbs, with shorter and harsher hair, a deep ferruginous red. Its habits in general seem to be those of the Indian dog.

The Siberian wild dog (*Canis alpinus*) much resembles the others in features and habits. It inhabits the forested regions of northern Asia as far south as the Altai Mountains and subsists almost entirely on deer, which it hunts in companies, pursuing them so constantly that it is said occasionally to destroy or drive away all the deer in certain districts. It also hunts the ibex in the high mountains. It appears that this semi-Arctic dog changes its summer coat of fox red for a long and woolly winter dress of yellowish white, as do the Arctic foxes.

There remains to be mentioned the dingo (*Canis dingo*), which by some naturalists has been set apart in a genus (*Dingo*) by itself. It inhabits Australia only and bears a considerable resemblance to the Himalayan wild dog. Although numerous in wild packs, it is also kept domesticated by the native Australians, by whose remote ancestors it may have been introduced into that island from the north. See **TINGO**.

**Interbreeding, Tamability, and Voice.** A few special considerations may well be made at this point, as tending to illuminate the relation which domestic dogs bear to the wild forms. First, it appears certain, although it may almost never occur under natural conditions, where the primal instincts of kinship prevent crossing of "species," that all the various canine animals may interbreed and produce offspring. This has been accomplished in the case of some species in captivity or a state of semidomestication. Whether these hybrid offspring are fertile with each other in every case, or usually, is not

so certain. A few instances are recorded in which they have been found to be so.

In respect to tamability canine animals are much superior as a tribe to feline animals, and perhaps no species intelligently tried has proved intractable. Pet examples of almost every species have been found among the savage or partly civilized peoples of the world, and the owners of menageries find even wolves submitting well to the trainers. There seems to be in the canine nature, disposing them to gather in packs and hunt in concert, and strengthened by these practices, a sympathetic element wanting in most other carnivores, the cultivation of which by man has led to the close affiliation between him and his dog, and to the expansion of the dog nature into the beautiful fidelity, appreciation, and affection it exhibits in its higher examples.

Wild canines may be said to howl, to yelp, to whine, to growl, and even—as some have mentioned—to bay when pursuing quarry; but none truly barks. Much attention was paid to this point by Mr. Bartlett, for many years keeper of the Zoölogical Gardens of London, who concluded from his observation of the captives of many wild species under his care that the barking of domestic dogs is an acquired habit, but one into which wild canines quickly fall by imitation. "A well-known instance of this," Mr. Bartlett wrote (*Proceedings of the Zoölogical Society of London*, 1890), "occurred under my notice. A wild Antarctic wolf, after a few months, hearing the barking of dogs in the immediate neighborhood, began to bark, and succeeded admirably. The same thing has happened to my knowledge in the case of pure-bred Eskimo dogs and dingos." See PLATES OF WOLVES AND WILD DOGS; FOXES AND JACKALS.

**Fossil Dogs.** The ancestors of the dogs, wolves, foxes, and jackals may be traced back through the Pliocene into the Miocene and Eocene periods, beyond which the ancestral forms become so generalized in type that they can with difficulty be placed in their respective categories, or separated from the ancestors of the civets and bears. Indeed, these families, together with the Canidæ, had a common origin in the Eocene carnivores, such as *Amphicyon*, *Calecyon*, *Cynodictis*, which are synthetic types. The modern family of Canidæ is a diphyletic group; i.e., it has had two sources. One series, terminating in the jackal, is thought to have had a common origin with the Viverridæ in *Cynodictis*. The second series, comprising the true dogs, foxes, and wolves, traces its ancestry from *Daphænus* and the earlier *Amphicyon*, which latter also gave rise to the bears.

**Origin of Domestic Dogs.** A great amount of discussion has taken place over the question of the origin of domestic dogs—whether they represent a separate species, or are the descendants of some existing canine species, or are of composite stock. The present diversity is so great that some dogs are no larger than the heads of others; that some are almost totally hairless, while others wear coats of hair longer than is elsewhere known among mammals, and some have narrow skulls with prolonged jaws, while in others the width of the skull is greater than its anteroposterior length, and the jaws hardly protrude beyond the forehead. Equally remarkable differences separate them temperamentally. The question then arose: Could all these variations be accounted for as the result of domesti-

cation and selective breeding acting upon a single species; and, if so, what traces remained to indicate what that species is, or was? It would be unprofitable to enter into all the speculations that have been recorded. Some have held that our dogs are only modified descendants of a wolf, the same or essentially similar to the modern common wolf; others, that all dogs are modified jackals. It has been extremely difficult for either school to find characteristics held in common by all varieties of dogs by which to make their comparisons and support their arguments. The upcurling of the tail, the drooping of the ears, the presence of "buttons" of tan over the eyes, and other alleged characteristics are not universal and seem comparatively unimportant. Probably the most singular characteristic possessed by dogs as contrasted with wild canines of every sort is a matter of voice—the bark; but those on the borderland of dogdom, such as the Arctic sledge dogs and the dingo, do not utter this peculiar sound, and, on the other hand, dingos, Eskimo dogs, and even wild canines, quickly acquire the habit when associated with tame dogs, by imitating them more or less completely. See DRINGO.

The consensus of modern scientific opinion is that our dogs represent the union of several strains, which during the long ages since this animal began to associate with wandering mankind, have been intermixed until only an indefinite trace of the original wild ancestry can be found; and that this process has continued to the present time. An important element, no doubt, is wolf; an equally important element, jackal. Foxes seem to have had a less part in the mixture, but the former assertion that foxes were unable to crossbreed with dogs is now known to be erroneous; such hybrids are uncommon, but do exist, and are no less fertile than other canine crosses, such, e.g., as those between domestic dogs and wolves or jackals, which constantly happen on the frontier of civilization, both by accident and by intention on the part of the owners. But it must be remembered that wolves and jackals are of various species and exist in many parts of the world, and that there are various other members of the dog family, such as the "wild dogs" of the Orient, described earlier in this article, the foxes, and the fox dogs and wolves of South America. Moreover, sufficient time has elapsed in all probability since the domestic races began for species of a smaller sort to have become extinct, perhaps largely through man's agency, partly by killing them, and partly by absorbing them into his domestic family. The peculiarities of certain races, such as the Japanese pugs and the hairless dogs of tropical America, are so great as to be accounted for with difficulty, except upon the supposition that they are the descendants of extinct species.

All canine animals exhibit, more or less plainly, the qualities which have contributed to make the character and value of the domestic dog what they are. They are courageous, quick-witted, and accustomed to possessing and defending home and property (their captures), and to the exercise of both nose and eyes, whose faculties are highly developed. More important, however, as rendering them susceptible to taming and the offer of human friendship, is their practice of hunting in companies and aiding one another, which has developed in them a social disposition much in excess of that in any other



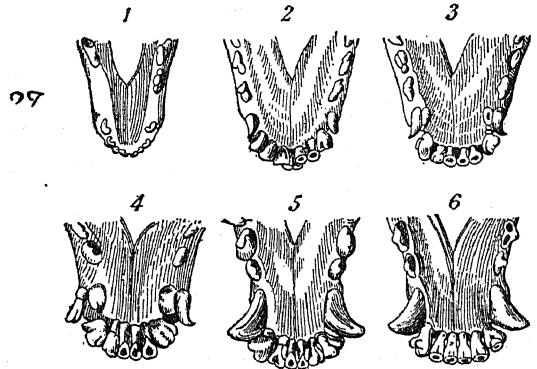
class of carnivores, and given them a sense of mutual dependence easily transferred to human companions and increased by continual human association. Hence the fact that in every part of the world, and from time immemorial, men have been found to own dogs, and the history of the dispersion of his dogs is bound up with the problem of the dispersion of man himself. The practice appears as far back as humanity can be traced. We may not be sure that Paleolithic man kept dogs as camp mates, but "Neolithic" man, he of the stone village on the hill and of the pile-built dwelling on the lake, certainly possessed and used them as an aid in keeping his flocks and herds. The oldest monumental remains of the valleys of the Indus, the Euphrates, and the Nile, show that dogs were common among these early peoples and in great diversity. Certain types well known to-day may be recognized, and will be referred to more particularly in the special articles on those breeds. Consult Berjeau, *The Varieties of Dogs* (London, 1865), a treatise upon dogs as they are found depicted in old sculptures, pictures, engravings, and books to the end of the seventeenth century.

It is certain that the first ones tamed were of local species, some of which in all probability have since become extinct. As tribes enlarged and spread out, their dogs would go with them. Here and there they would encounter and coalesce with other peoples, and an intermingling of dogs would follow. This, going on indefinitely and complicated by constant intermixture with new blood from the forest—for in no group of animals is interfertility more general—would speedily bring about a great variety of forms. In addition to this, however, there must have gone on from the very first, besides the varying influences of new climate, food, and general environment, a certain amount of selective breeding.

It has been held by Professor Shaler and others that the first motive leading to domestication of the dog was to provide a resource against the recurring famines that afflict aboriginal life, while others suppose the animal's aid in hunting first made it valuable. Undoubtedly, then as now, the dog was eaten on occasion, but it would certainly make itself so useful as a watchdog and a hunter as quickly to win regard; and there is no doubt that the personality of the animal would appeal to the affection of the primeval savages as it does to-day. No other human beings are regarded as so rude and autochthonous as the northern Australians, yet while they eat both the wild and tame dingos, and use the latter in hunting, they regard many of them as pets, lavish affection upon them, and even nurse the puppies at the women's breasts. In recognition of these qualities, the best or most interesting puppies and older dogs would naturally be saved when any were to be killed for food or other purpose. In such isolated circumstances as those of the Australians, where there is free and constant intercourse between the wild stock and the tame, this would have little effect; but in general, where the mixture of several wild breeds had already produced diverse hybrids, the unconscious selection thus brought about would soon be effective, and would be followed, as civilization began, with a more intelligent and definite kind of choice, which must have originated selective breeding long before any his-

tory of it begins. It must have been intelligently and persistently practiced, in fact, long before the earliest civilized records, for monuments inscribed four or five thousand years ago bear pictures of widely diversified and perfectly bred races of dogs, such as greyhounds. Consult Lydekker, *Mostly Mammals* (London, 1903), and Duerst, *Martin Wilckens Grundzüge der Naturgeschichte der Haustiere* (Leipzig, 1905).

Varieties of Domestic Dogs. No one probably has ever attempted to make a complete



GROWTH OF A DOG'S TEETH.

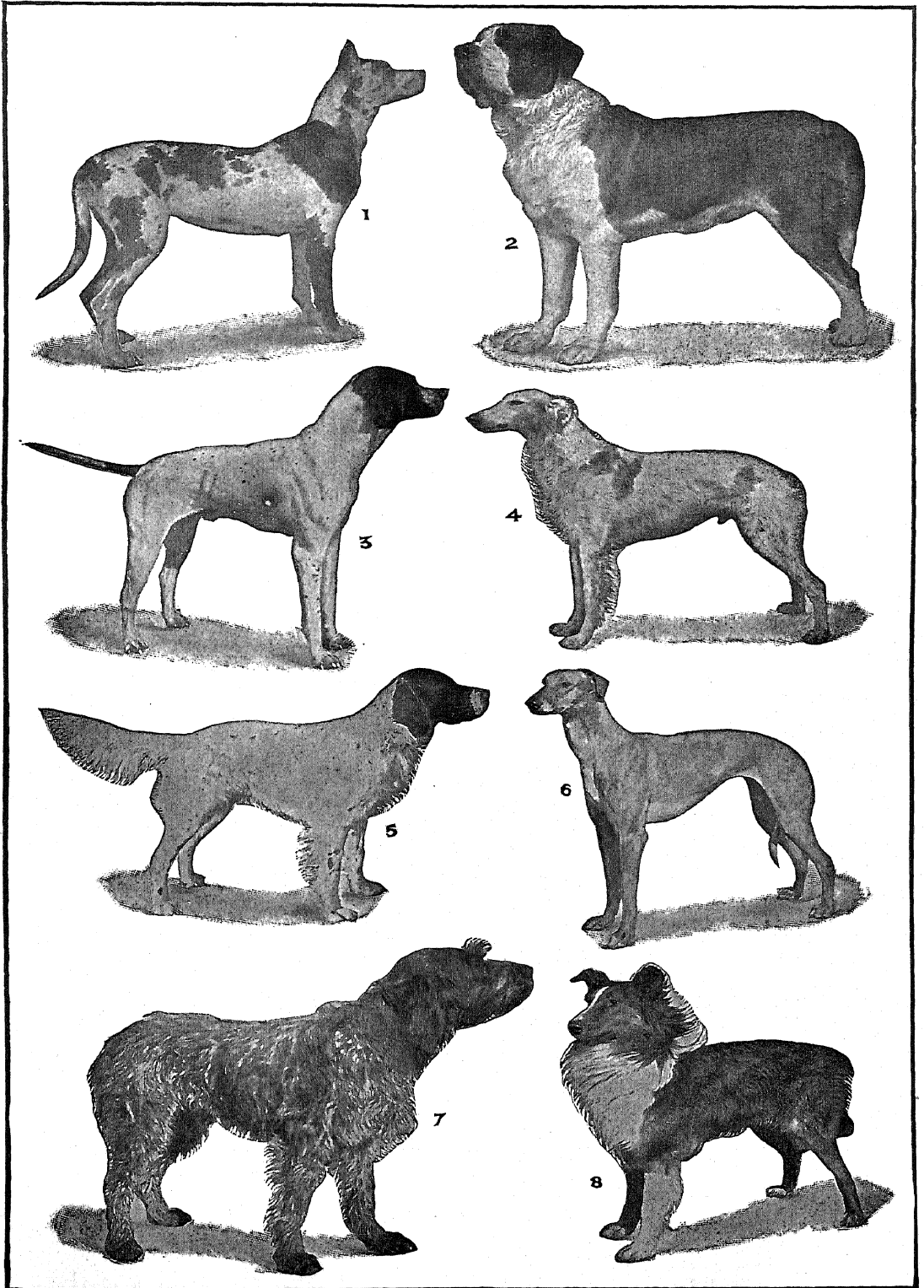
Development of dentition in the lower jaw at various successive ages: 1, two days; 2, four months; 3, six months; 4, nine months; 5, eleven months; 6, four years.

catalogue of the varieties of domestic dogs known throughout the world, but Fitzinger estimated the number in 1876 at about 185. All these fall into certain groups, or types, as will presently be noted; and the study of their points of likeness and unlikeness has been made by several recent investigators of the law of variation. One of the most recent and successful of these was a comparison by Windle of the skulls of some 60 varieties, representing most of the types, the results of which were extensively tabulated and discussed in the *Proceedings of the Zoological Society of London* for 1890. He says that the most noteworthy fact learned from his comparative measurements of dog crania was that the averages of the different breeds, especially in points relating to some of the teeth, differ very little from one another; in other words, that, speaking generally, the teeth in one dog are relatively to the skull very similar in size to those of any other. It is also to be noticed that the range of variation in any breed is much greater, in almost every case, than that existing between any two breeds. Mr. Windle says:

"The extreme variations in any breed are probably due to the fact that, strictly speaking, so few animals of the same group are really in any sense of the same breed. The various members of a carefully selected strain of terriers, for example, bred by one breeder, might be comparable with one another, and yet quite different in descent from another and perhaps equally good strain belonging to another breeder and to another part of the country. With dogs bred for show purposes, as so many of the pure strains are, and with constantly varying requirements of fashion, all sorts of crosses, as any manual of dog breeding will show, have been tried with a view of attaining the ideal, whether of symmetry, pace, or carriage. That such



# HUNTING AND WATCH DOGS



1. GREAT DANE, "Monticello Pearl."
2. ST. BERNARD, "Prince Napoleon."
3. POINTER, "Champion Boy."
4. RUSSIAN WOLFHOUND, "Marksman."

5. ENGLISH SETTER, "Knight Errant."
6. GREYHOUND, "Leeds Music."
7. GRIFFON, "Blitz von Kaiserlauten."
8. COLLIE, "Emerald Eclipse."



crosses should, at times at least, leave their marks upon the skulls, and cause differences in breeds which cannot be accounted for, is, of course, to be expected. The presence of the disturbing factor can be appreciated, though its exact nature cannot always or even frequently be ascertained with any correctness. Thus, amongst the 11 bulldogs' skulls which we have examined, there was one which differed in measurements considerably from the rest. It was nearly one centimeter longer than any other, and, what is much more significant, it was seven centimeters longer than it was broad, the average for the others being about three or four centimeters. Moreover, its palate was 1.90 centimeters longer than it was broad, whilst in every other case but one the breadth exceeded the length. In the second case the length was .90 greater than the breadth of the palate, and the length of the skull nearly five centimeters greater than the zygomatic width. We cannot doubt that both of the skulls above mentioned were those of dogs in whom, to a greater or lesser degree, there was an admixture of strain, of what kind it is impossible to say. And what is true of these is doubtless true also in lesser degree of the greater number of specimens coming under examination. It thus becomes apparently a hopeless task to look for evidence as to the proximate or ultimate derivation of the breeds of domestic dogs in their skulls or teeth."

Having arranged his skulls with reference to relative length and breadth, Mr. Windle found that the distinctly broad-headed dogs form a well-marked group by themselves, including the Chinese pug-nosed spaniel, the pug, bulldog, black-and-tan toy terrier, and King Charles spaniel, a considerable interval existing between these and the next. All these are highly artificial breeds, which require great care and attention in order to prevent deterioration, with its consequent elongation of the skull. Next to this group comes one, largely consisting of terriers, with heads inclining to be broad. A miscellaneous group next follows, gradually decreasing to the distinctly narrow-headed dogs, such as the Irish wolf dog and the greyhound.

These investigations demonstrated the fact that in the highly artificial broad-headed dogs elongation of skull and palate is a sign of impure breeding, an evidence of admixture with the broad-headed strain of that of some other and narrower-headed dog. Examples of this may be seen almost any day in the streets in the shape of the half-bred pugs, in which the elongated muzzles present so great a contrast with the short, square faces of their pure-bred cousins. We have no facts before us to prove whether the long-headed dogs, such as greyhounds, tend to become broader when impurely bred, but it is highly probable that they would do so, and consequently that the dogs at both ends of the scale would, under the influence of promiscuous interbreeding, tend to approximate to the average head.

**Classification.** Breeds of dogs have been variously classified. One Roman grouping mentioned by old writers was into fighters (*pugnaces*); wise dogs (*sagaces*), and swift-footed ones (*celeris*); the *sagaces* were said to have come from Greece, and the *pugnaces* from Asia. Another ancient grouping was into house dogs, sheep dogs, and sporting dogs; the last embracing fighters, hounds hunting by scent and hounds

hunting by sight. Modern naturalists have substantially agreed upon six groups, with considerable differences in composition, however. Thus, Col. Hamilton Smith, about 1830, arranged the list as follows: 1. The wolf dogs, including the Siberian dog, Eskimo dog, Iceland dog, Newfoundland dog, Nootka dog, sheep dog, great wolf dog, great St. Bernard dog, Pomeranian dog, etc. 2. The watch and cattle dogs, including the German boarhound, Danish dog, matin dog of the North American Indians, etc. 3. The greyhounds, including the Brinjee dog, different kinds of greyhound, Irish hound, lurcher, Egyptian street dog, etc. 4. The hounds, including the bloodhound, old southern hound, staghound, foxhound, harrier, beagle, pointer, setter, spaniel, springer, cocker, Blenheim dog, water dog, or poodle, etc. 5. The cur dogs, including the terrier and its allies. 6. The mastiffs, including different kinds of mastiff, the bulldog, pugdog, etc.

The latest arrangement is that by Windle, based upon the shape of the skull and other features rather than upon form and function, yet not greatly different from its predecessors. It is as follows:

I. *Wolflike Dogs*.—Arctic sledge dogs; shepherd dogs (collies); Newfoundland dog; St. Bernard, rough and smooth, and Pomeranian or Spitz dog.

II. *Greyhounds*.—Old Irish wolf dog; modern Irish wolf dog; greyhound; Italian greyhound; West Indian naked dog ("presumably").

III. *Spaniels*.—All varieties.

IV. *Hounds*.—Bloodhound; foxhound; harrier; otter hound, beagle, pointer, setter, etc. (hunting dogs).

V. *Mastiffs*.—Mastiffs; bulldogs; pugs, etc. (the "watchdogs," notable, as a class, for the extraordinary range of size).

VI. *Terriers*.—English, Scotch, Irish, and Skye terriers; fox terriers (pure), black-and-white terriers, turnspits, and the Oriental pariah dogs.

For the purposes of this *ENCYCLOPÆDIA* the domestic dogs have been grouped, and will be found described under the following headings: CHOW CHOW; FIELD DOG; GREYHOUND; HAIRLESS DOG; HOUND; NEWFOUNDLAND DOG; POODLE; PUG; ST. BERNARD DOG; SHEEP DOG; SLEDGE DOG; SPANIEL; TERRIER.

**The Dog in Law.** The dog occupies an anomalous position in the law. Though not belonging to the animals of a wild nature (*feræ nature*), he was not, on the other hand, like most other domestic animals, regarded by the common law as the subject of property—at least, while alive; though it was held in an early case that a man might have a right of property in the skin of a dead dog. He belonged, like the cat, the fox, and the monkey, to animals of a "base nature." The utility of certain species of dogs, especially in hunting, gradually gained for them a certain legal recognition, and in the time of Elizabeth we find it laid down that the law takes notice of greyhounds, mastiffs, spaniels, and tumblers, and that an action in trover will lie against any one who takes and detains such a dog from the owner. But the offense was not punishable criminally at common law. By a statute of George III (1770), however, it was enacted that the stealing of any dog was a misdemeanor, punishable by fine, imprisonment, or whipping. In a few of the United States similar statutes

have been passed, but in general the dog retains his inferior common-law status in this country, as not the subject of larceny. In most of the States, however, it is probable that an action in trover would lie for the recovery of a valuable dog, though the question has been passed upon only in a few jurisdictions.

On the other hand, it is generally lawful to keep a dog, and in the absence of general laws or local ordinances to the contrary, to allow him to go at large. The owner is not responsible for injuries caused by his dog unless the latter is of a savage or vicious temper and the owner knew or had reason to believe that the animal was dangerous. In the latter case the owner is absolutely responsible without proof of special negligence on his part. So, if a dog, because of his vicious temper, becomes a common nuisance, the owner may be indicted. And even in a State in which a dog is recognized as property, he may be killed in self-defense, or after due notice to the owner if dangerous to the community. It is common in many jurisdictions to impose a license or other tax on dogs, and in nearly all States the terms on which they may be kept and allowed to run at large are regulated by statute or by municipal ordinances. It is not a violation of the constitutional protection of property in the United States to exterminate dogs in the public interest. See PROPERTY; TORT; and consult the authorities there referred to.

**Bibliography.** Stonehenge, *The Dog*, etc. (see below); Gray, "Varieties of Dogs," in *Annals and Magazine of Natural History*, 4th series, vol. iii (London, 1869); Huxley, "Cranial and Dental Characters of the Canidæ," in *Proceedings of the Zoological Society of London* (ib., 1880); Mivart, *Dogs, Jackals, Wolves, and Foxes* (ib., 1890); Wortman and Matthew, "The Ancestors of Certain Members of the Canidæ, Viverridæ, and Procyonidæ," *Bulletin of the American Museum of Natural History*, vol. xii (New York, 1899); Beddard, *Mammalia* (London, 1901). The literature relating to domestic dogs, and especially to those used in the chase, is exceedingly extensive in all languages. A selection of important books in English is as follows: Caius, *De Canibus Britannicis* (ante 1572), a Latin essay by a celebrated naturalist of the sixteenth century; George Tuberville, *The Noble Art of Venerie or Hunting* (London, 1576), the earliest illustrated book of the dog; J. H. Walsh ("Stonehenge"), *Dogs of the British Islands* (ib.); id., *The Dog in Health and Disease* (ib., 1859). Standard and modern works: W. Youatt, *Training and Management of the Dog* (London and New York, 1859); Rev. William Pearce ("Idstone"), *The Dog* (ib., 1872); Vero Shaw, *Illustrated Dog Book* (London, 1890); id., *Training of the Kennel* (New York, 1913); id., *The Dog in Health and his Treatment in Disease* (ib., 1892), valuable especially as a veterinary guide; R. B. Lee, *A History and Description of the Modern Dogs* (London, 1897); H. W. Huntington, *The Show Dog* (Providence, 1901); H. Bylandt, *Dogs of All Nations* (Philadelphia, 1905); F. T. Barton, *Our Dogs and All about Them* (Boston, 1911).

**DOG'BANE** (*Apocynum*). A genus of plants of the family Apocynaceæ. Some of the species are shrubby, some herbaceous; some extend into colder climates than is usual for plants of this

order. The Dogbane of North America (*Apocynum*) is a perennial herbaceous plant, about 4 feet high, with smooth stem, much milky juice, smooth ovate leaves, and whitish rose-colored flowers. It grows in open barren places from Canada to Canada. It is valued for the emetic, cathartic, and tonic properties of the bark of its root. The root of Canadian or Indian hemp (*Apocynum cannabinum*) possesses similar properties. This species abounds throughout the western portion of the United States. It furnishes a fine, long, strong, white, easily separable fibre, employed to a considerable extent by the Indians, who manufacture it into numerous articles. (See APOCYNUM.) For illustration, see Plate of DAHLIA.

**DOG'BERRY.** A city officer and servile clown in Shakespeare's *Much Ado About Nothing*. He utters the much-quoted phrase, "Write me down an ass."

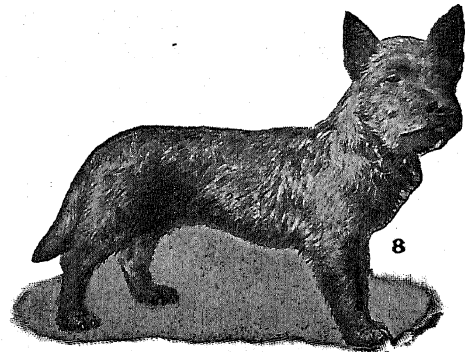
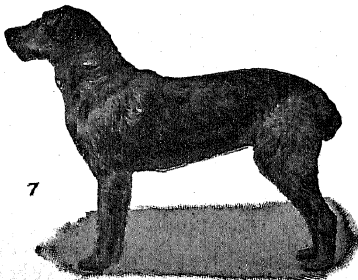
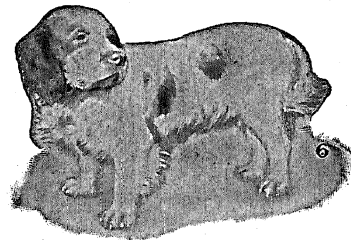
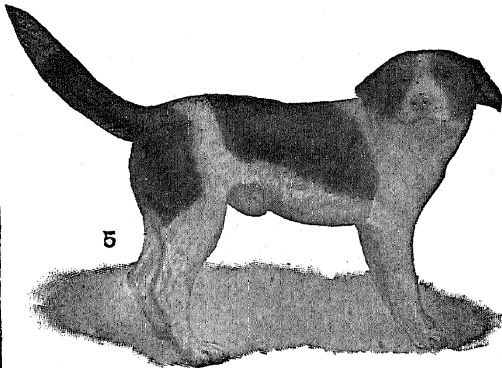
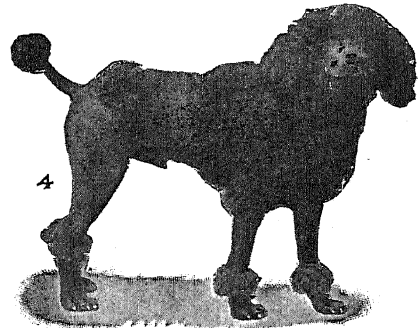
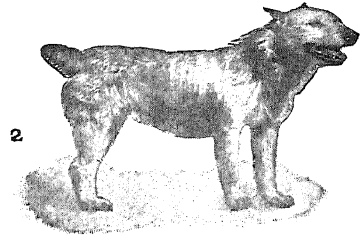
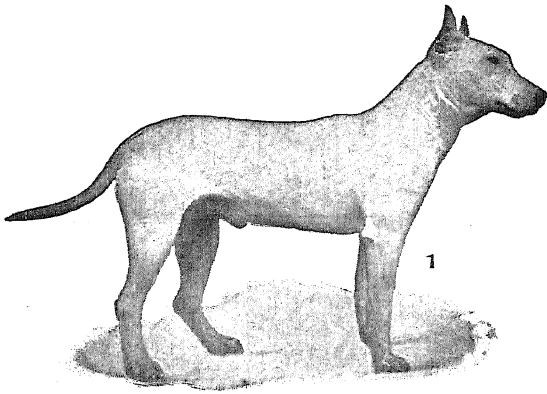
**DOG BREAKING.** See FIELD DOG.

**DOGCART.** See CART.

**DOG DAYS.** See CANICULA.

**DOGE**, dōj (It., variant of *duca*, duke, from Lat. *dux*, leader). The name of the chief magistrate in the former republics of Venice and Genoa. The first Doge of Venice, Paolo Lucio Anafesto, was elected by the people in 697. Before that time the various islands had been governed by tribunes, but the divided authority had been found inefficient in times of danger. At first the power of the Doge was not strictly defined and depended mainly upon the character of each incumbent, though the consent of the General Assembly was necessary for a declaration of war or the making of a treaty. An able Doge usually endeavored to make his office hereditary, and in order to do this to have his son appointed as consort; but the people resisted this tendency, as they did not wish "to live under a lord," and by 1033 the antidynastic principle triumphed and the election of the Doge Consort was declared illegal. In order to aid the chief magistrate in his constantly increasing duties, instead of a consort, two *Consiglieri Ducali*, or privy councilors, were appointed. At the same time, as a restriction upon his power, the Doge was obliged to call the more prominent citizens to aid him with their advice. This was the foundation of the Senate, or *Pregadi*. From this time the power of the Doge was gradually restricted by legislative enactment. In the earlier periods the usual remedy against tyranny had been violence, and several doges had been deposed, blinded, or put to death, but after 1033 tyranny was guarded against by constitutional checks. In 1172 the Great Council, *Maggior Consiglio*, of 480 members was created. These represented the different sections and held office for one year; they made appointments to office and prepared all business which was to go before the General Assembly. In addition the assembly of the *Pregadi* was given greater power, and four more ducal councilors, making six in all, were appointed. Later constitutional changes follow along these same lines. On the one hand, power is taken away from the people as represented in the General Assembly; on the other hand, the influence of the Doge is gradually restricted until he becomes a figurehead, though the pomp and dignity of the office are increased. These changes, however, were made very gradually, and some of the strongest doges ruled during the thirteenth and fourteenth centuries. See DANDALO.

TERRIERS, SPANIELS, ETC.



1. BULL TERRIER, "Woodcock Wonder."
2. AIREDALE TERRIER.
3. ENGLISH BULLDOG, "Katerfelto."
4. POODLE, "Milo Boy."

5. BEAGLE, "Primate."
6. CLUMBER SPANIEL "Medway."
7. IRISH TERRIER.
8. SCOTCH TERRIER, "Adora Alexander."



The people resisted strenuously when the Council attempted to deprive them of the right of electing the Doge. Finally the Council hit upon the expedient of electing the Doge and then presenting him to the people with the following formula: "This is your Doge, if it please you," a formula which was used until 1423. The method of electing the Doge was modified frequently with the purpose of preventing partisanship and corruption. In 1268 the following method was adopted:

The Great Council by lot chose . . . . .	30	
The 30 were reduced by lot to . . . . .	9	
The 9 voted for . . . . .	40	{ with at least 7 votes each
The 40 were reduced by lot to . . . . .	12	
The 12 voted for . . . . .	25	{ with at least 9 votes each
The 25 were reduced by lot to . . . . .	9	
The 9 voted for . . . . .	45	{ with at least 7 votes each
The 45 were reduced by lot to . . . . .	11	
The 11 voted for . . . . .	41	{ with at least 9 votes each
The 41 elected, with a minimum of twenty-five votes, the Doge.		

The power of the Doge was greatly circumscribed, especially after 1229, by making the coronation oath more strict, by the establishment in 1310 of the fearful Council of Ten, and by the appointment of inquisitors to examine in detail all the acts of the deceased Doge. By the coronation oath of Tiepolo, in 1229, he was forbidden to correspond with the Pope, the Emperor, or any other sovereign without the consent of the ducal councilors, and the size of his household was fixed. Loaded down with burdensome conditions and clothed only with empty honors, the office ceased to be sought for. In 1361 the Doge was required to abdicate when asked to do so, but was not allowed to resign of his own accord. A few years later Andrea Contarini was forced to accept the office against his own will, under threat of a confiscation of his property, but in compensation was given a larger household. In 1437 Venice felt the need of a title to the land empire which she had acquired, and the Doge obtained a diploma of investiture from the Emperor, creating him "Duke of Treviso, Feltre, Belluno, Ceneda, Padua, Brescia, Bergamo, Carrara, Soncino, and Peschiera." In spite of this the Doge had little real power in the last centuries of the republic's existence; the office disappeared with the fall of the republic in 1797.

The republic of Genoa elected, after a victory gained by the party of the people, in 1339, Simone Boccanera for its first Doge. In 1396, when Genoa came (for a short time) under the rule of the French, the office of Doge was suppressed. It was revived in 1528, when a new aristocratic constitution was instituted under the auspices of Andrea Doria. In most respects the office was restricted, as in Venice. In 1797, when Genoa was occupied by the French, the office was abolished. It was reestablished in 1802 for the Ligurian Republic and again abolished in 1805, when the republic came to an end. Consult Brown, *Venice* (New York, 1893); *Studies in the History of Venice*, vol. i (London, 1907); Checchetti, *Il Doge di Venezia* (Venice, 1864); Hazlitt, *The Venetian Republic* (2 vols., London, 1900); Picotti, *La dieta di Mantova e la politica de Veneziani* (Venice, 1912).

**DOGE'S PALACE, THE.** The residence for four centuries of the dukes (doges) of Venice,

situated on the Piazzetta adjoining the Piazza of St. Mark; founded about 814, and subsequently destroyed and rebuilt five times. The present reconstruction was begun in 1340; the Gothic façade dates from the first half of the fifteenth century. Its architecture makes it one of the most striking buildings in Europe. On the south and west sides a noble arcade resting on 36 columns, surmounted in the second story by a superbly traceried arcade on 71 smaller columns, supports the two upper stories. These form a heavy square mass, relieved by balconies, pointed arches, and surface patterning in light and dark marbles, and the whole is crowned with a battlemented cornice. The Porta della Carta, so called because it was the washroom of the secretaries who prepared the documents (*Carte*) exemplifies the final efflorescence of Gothic art; the Court and the Giants' Staircase, at the head of which the doges were crowned, are among the most perfect early works of the Venetian Renaissance. They are the work of Pietro Lombardi and Antonio Rizzo (1483-90). On the east the palace is connected by the famous Bridge of Sighs with the old prisons. The building is rich in historical memories. It contains the magnificent Sala del Maggior Consiglio, or Great Council Hall, in which the meetings of the Nobili were held; and the Sala della Scrutinio, or Voting Hall, both surrounded with historical paintings; the Archaeological Museum; the famous Bocca di Leone, an orifice opening into the anteroom of the Inquisitors and used to deposit secret information and accusations; torture chambers and dungeons, and the place of execution for political offenders. Many of the most glorious works of the great Venetian triumvirate of painters of the sixteenth century—Titian, Veronese, and Tintoretto—adorn the walls and ceilings of the more important rooms. Consult Hare, *Venice* (several editions.).

**DOG FEN'NEL.** See FEVERFEW; MAYWEED.

**DOGFISH.** A popular name for small sharks, apparently because they follow their prey like dogs hunting in packs; also "hound" and "bone-log." It is most commonly given in the United States to *Squalus acanthias*, of the "dogfish" family Squalidae, of which characteristically there is a spine before each of the two dorsal fins; spiracles, or spout holes; five gill openings on each side, all before the pectoral fins; no anal fin and no nictitating membrane of the eye. It is oviparous. The body is long and tapering; the head flat; the snout conical, the teeth in both jaws sharp-edged and formed for cutting. It attains a length of 3 to 4 feet and a weight of 10 to 15 pounds. It is abundant on both coasts of the North Atlantic. The dogfish of the Pacific Coast of North America is taken in great numbers for the sake of the oil extracted from its liver. (See Plate of LAMPREYS AND DOGFISH.) The same name is given to the "requiem sharks" (Gulidae), especially to the smooth hound, or "dog shark" (*Mustelus canis*) of the North Atlantic (see TOPE), which resemble the Squalidae in general form, but have an anal fin and are ovoviviparous; also to the bowfin (q.v.).

**DOGGERBANK** (Eng., Ger., Dutch *dogger*, sort of Dutch fishing boat + *bank*). An extensive flat sandbank near the middle of the North Sea between England on the west and Denmark on the east, with a maximum breadth of 60 miles and an average breadth of about 40 miles. It stretches northeast and southwest for



a distance of about 200 miles between the limits of lat. 54° 10' and 55° 40' N. and long. 1½° and 5° E. It has in general a depth of less than 120 feet and towards the English coast has little over 50 feet of water. This bank furnishes important codfishing grounds. On the night of Oct. 21, 1904, the Russian Baltic squadron, under Admiral Rozhdestvensky, on its way through the North Sea to the Far East, fired upon a British fishing fleet on the Dogger, killing two men. The incident was finally settled by arbitration, Russia paying damages for loss sustained. The action of the Czar's fleet was due probably to sudden panic.

**DOG'GETT**, or **DOGGETT**, THOMAS (?-1721). An English comedian and manager. He was born in Dublin. He appeared in 1691 in London at Drury Lane, as Nincompoop in *Love for Money*. In 1695 he first played the part of Ben in Congreve's *Love for Love* with Betterton at Little Lincoln's Inn Fields. The next year he played Hob in his own piece called *The Country Wake*. In 1701 he played Shylock, as a comic part, to Betterton's Bassanio. He became, in 1709, one of the managers of the Haymarket, but left his partners about four years afterward, and later played a few times at Drury Lane. The well-known prize which bears his name, Doggett's Coat and Badge, was founded in 1716 in celebration of the accession of George I. Consult Doran, *Annals of the Stage*, ed. by Lowe (London, 1888), and *Thomas Doggett, Deceased* (ib., 1908).

**DOG GRASS.** See **COUCH GRASS**.

**DOGMA** (Lat., from Gk. δόγμα, *dogma*, from δοkein, *dokein*, to seem). Originally an opinion or proposition, put as a positive assertion, its truth being supposed to have been previously shown. In theology it was understood to signify a doctrine defined by the Church and advanced, not for discussion, but for belief. But as this method of stating truth easily degenerates into the assertion of opinions without ground, and without regard to the aspect they may present to others, *dogma* and *dogmatism* have come in English to be frequently used for assertion without proof.

In continental theology, however, the word is still used without implying any censure, dogmas (Ger. *Do.* . . . . .) simply doctrines conceived as . . . . . the Christian Church; and this is the case in our own expression "dogmatic theology," or "dogmatics," which is that branch of theology that treats of the systematic arrangement of the doctrines of Christianity. The first attempt to give a connected view of Christian doctrine was made in the fourth century by Augustine, who in his *Encheiridion* and other works treated of the whole body of doctrine held by the Church, though without any very scientific arrangement. The contributions to dogmatics made in the fifth, sixth, and seventh centuries were mere collections of "sentences." In the East, in the eighth century, the doctrines of the Greek church were treated by John of Damascus in a form already Aristotelian, and his work may be considered the first systematically arranged treatise on dogmatics. His book was as influential in the Greek church as the writings of Augustine in the Latin. The regular systematizing of doctrines began with the Scholastics in the eleventh century. The first cultivators of dogmatic theology among the Scholastics were Hildebert of Tours (died 1133) and Abélard (died 1142), who were fol-

lowed by Petrus Lombardus (died 1164), Alexander of Hales (died 1245), Thomas Aquinas (died 1274), Duns Scotus (died 1308), etc.

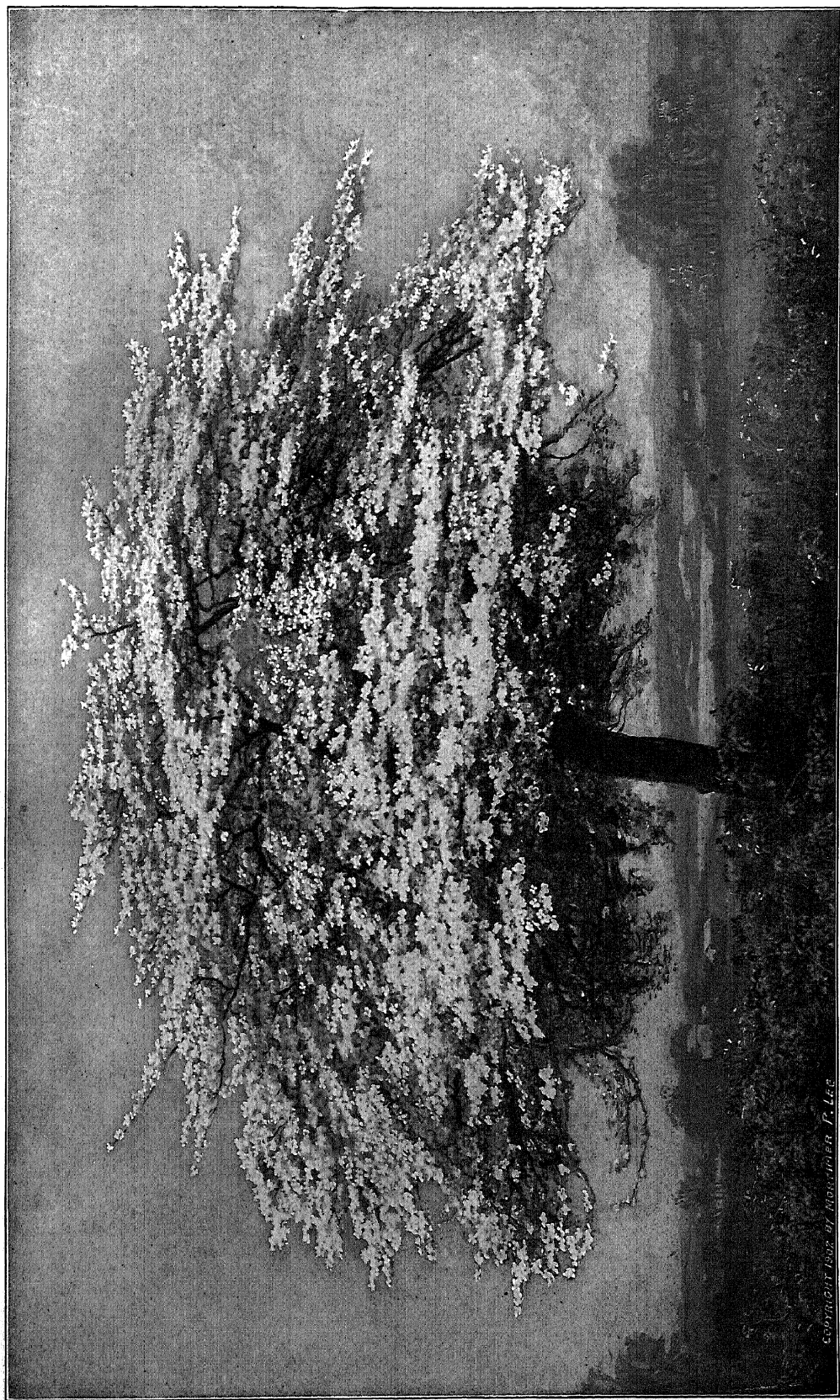
The era of the Reformation revived dogmatic controversy, leading it back from Aristotle to biblical theology. But the controversies between the different churches in the seventeenth century and the too great importance attached to confessions of faith, cramped anew its freedom and gave it again a Scholastic turn. (See REFORMATION; GERMAN THEOLOGY.) The theologians of the Roman Catholic church have devoted much labor in modern times to the production of systematic treatises, which usually adhere to the old logical methods of the schoolmen, while taking account of all modern objections to what they consider revealed dogmas. The names of Canisius, Petavius, Thomassin, Bellarmine, Suarez, Liebermann, and Perrone may be mentioned among a host of others in the last three centuries. Pope Leo XIII has consistently held up St. Thomas Aquinas as the norm of modern dogmatic theology and has caused an increased study and use of his works. As a result of the Tractarian movement, much more attention than formerly has been paid to dogmatic theology in the Church of England and its allied bodies. In America systems of doctrine have been produced, among others, by Dwight, Smith, Hodge, Shedd, Strong, Clarke, and Brown. Most of these, however, present doctrine, not as an authoritative dogma, but as a reasoned system of thought. For the history of dogmas, see DEVELOPMENT OF DOCTRINE; CREEDS AND CONFESSIONS.

**DOGMATISM.** In philosophy, the assumption of metaphysical knowledge without examining the conditions and the limits of the possibility of knowledge. It is the willingness to accept what are supposed to be self-evident truths or the facts of experience without any further ado. All naïve consciousness is in a certain sense dogmatic. The infant apparently does not question the reality of his experiences. But in time the inconsistencies into which he gets by accepting without question everything that comes to him as knowledge call attention to the fact that all is not valid knowledge that seems to be. If, in spite of this fact, a theorist still accepts any particular as valid in respect to ultimate reality, without first inquiring whether knowledge of such reality is possible, and whether a tenable theory of knowledge validates those judgments, he is a philosophical dogmatist. Philosophical dogmatism may then be defined as the attempt to philosophize without basing one's philosophy on a scientific epistemology. Pre-Kantian philosophy was dogmatic; Kant inaugurated an era of criticism (q.v.) in opposition to this dogmatism. This critical attitude has prevailed till the last decade. Within the last few years there has been a revolt against criticism resulting in some cases in a return to dogmatism. But this recent dogmatism differs from pre-Kantian dogmatism in that it relies more on experience and less on reason. Consult Marvin in *The New Realism* (New York, 1912). See KNOWLEDGE, THEORY OF; CRITICAL PHILOSOPHY; EMPIRICISM; INSTRUMENTALISM; PRAGMATISM; REALISM.

**DOG OF MONTARGIS**, mōn'tār'zhé'. See AUBREY DE MONTDIDIER.

**DOG-RIBS.** A Déné (q.v.) tribe in Canada ranging around Great Slave Lake. See ATHEPASCAN STOCK.

DOGWOOD TREE

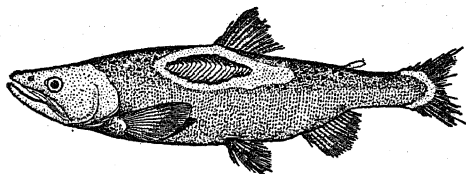


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DOGWOOD TREE (*Cornus florida*); Southern New York, early May.



**DOG SALMON**, sām'ūn. 1. A salmon (*Oncorhynchus keta*) of the northwestern American coast, which resembles the quinnat, but is much smaller and without spots on the fins. It ascends all streams from San Francisco to Kamchatka, but its flesh is of little value. Native names are hay-ko, le kai, and keta. 2. In



A DOG SALMON.

Alaska, an allied species known as the hump-back salmon (*Oncorhynchus gorbusha*). (See SALMON.) 3. The adult male of any salmon, when it is ascending a river in the breeding season, or attending upon the females at the spawning grounds. In the course of this duty the fish take no food whatever, and succumb soon after spawning, regardless of the distance or proximity of the sea.

**DOG SHARK.** See DOGFISH; TOPE.

**DOG'S MERCURY.** See MERCURY, Dog's.

**DOG'S-TAIL GRASS** (so called because its spike is fringed only on one side), *Cynosurus*. A genus of grasses having a close spike, each spikelet with two equal glumes and three to five florets. The species, which are not very numerous, are chiefly natives of Europe and Asia; but one only is common and valuable, the crested dog's-tail grass (*Cynosurus cristatus*), which forms an important part of almost all good pastures and is particularly esteemed for sheep pastures and lawns, for the improvement of which it is often sown. It is a perennial grass, growing in tufts 1 or 2 feet high, with many fine root leaves. Its herbage is fine and close, and its deep roots secure it against droughts, which cause many other grasses to wither; but the herbage is not sufficient in quantity to make it desirable for hay. The seeds are small, shining, and yellow, whence the name "goldseed" sometimes given to this grass by farmers. The mature stems of this grass are used in the manufacture of Leghorn hats. It has been sparingly introduced into the United States. It grows best on rich moist soil and, as it endures shade well, is adapted to shaded lawns.

**DOG STAR.** See SIRIUS.

**DOG'S-TOOTH VIOLET.** See ERYTHRONTIUM.

**DOGTTOOTH.** In architecture a carved ornament frequently occurring in English Gothic work of the late twelfth and early thirteenth centuries, in the form of small square pyramids set at close intervals or even in direct contact in the hollow between two salient moldings, the sides carved like the petals of a flower; called also *pyramid flower*.

**DOGUERA.** A baboon (*Cynocephalus*, or *Papio*, *doguera*) of Abyssinia, more olive in color than the sacred baboon (see BABOON), but possibly a variety of it.

**DOGWATCH.** The two short watches of two hours each, from 4 to 6 p.m. and 6 to 8 p.m. These watches were introduced for the purpose of securing a change of watch each day for the watch officers. As it makes 7 watches per lay instead of 6, it causes officers to have dif-

ferent watches every day, if there are less than 7—and the number rarely exceeds 5—except on large men-of-war or for a few days at a time. See WATCH.

**DOG WHEELK.** See WHEELK.

**DOGWOOD.** A name given to some of the shrubby and aborescent species of the genus *Cornus*. There are about 25 species indigenous to Europe, Asia, and North America, most of which are shrubs, although a few become trees. The common dogwood (*Cornus sanguinea*) of Europe is a shrub 12 to 18 feet high. As with all the larger shrubs and trees of the genus, the wood is hard and the bark bitter. The fruit is small, and in France an oil used in soap-making is expressed from it. The Cornelian cherry (*Cornus mas*), also a native of Europe, yields an edible fruit, which is sometimes used for preserves. *Cornus kousa* and *Cornus capitata* are trees in the eastern part of Asia, and *Cornus florida*, *Cornus alternifolia*, and *Cornus nuttallii* in the United States. The last-named species is the largest of the genus, trees often reaching a height of 70 to 90 feet and a diameter of 2 feet. It is confined to the Pacific coast region from British Columbia southward. The common tree species in the United States is *Cornus florida*, which is found from Massachusetts to Texas. It is a small tree rarely more than 30 feet tall, and is well known on account of its four, sometimes more, white or pink showy bracts ("flowers," which surround the inconspicuous greenish-yellow true flowers). In *Cornus nuttallii* the bracts are a deep pink and are 4 or 5 inches across, making the tree a very striking object in the forest. The berries are red and remain on the trees during most of the winter. The wood is white, hard, and fine-grained, and is much used for inlaying, turning, etc. The bark of *Cornus florida* contains a bitter tonic principle somewhat resembling that found in cinchona, like which it has been used to some extent in the treatment of fevers. Other species also contain it, but in smaller quantities. Two dwarf herbaceous species are common at high latitudes, *Cornus canadensis* and *Cornus suecica*. They are but a few inches high, have small, white-bracted clusters of flowers and red berries, often called bunchberries, from their habit of growth. The shrubby species are common along watercourses and do not have bracts to their flowers. Some of them are quite showy when in flower, and also in winter, when their stems are bright red. The autumn coloring of all the species is very striking, red colors prevailing. In the West Indies *Piscidia erythrina*, a leguminous tree, is known as dogwood. Its timber is hard and very durable. The bark contains a narcotic substance frequently used for stupefying fish, and as an anodyne in medicine. Poison dogwood—or poison sumac, as it is more properly called—is *Rhus vernia*, a species nearly related to and greatly resembling the *Rhus* of Japan, one of the trees from which, through the action of the lac insect (*Casteria lacca*), the lac of commerce is derived. See Colored Plate of POISONOUS PLANTS. See CORNEL.

**DOHERTY**, dōh'ēr-tī, CHARLES JOSEPH (1855- ). A Canadian lawyer and statesman. He was born at Montreal and was educated at the St. Mary's College and McGill University, where he graduated in 1876. He chose the legal profession, was called to the bar in 1877, and soon gained a large practice.

In 1883 he was appointed a member of the Royal Commission to investigate the working of the Protestant and Catholic school boards, Montreal. He afterward became professor of civil and international law in McGill University. In 1891-1906 he was a puisne judge of the Superior Court of Quebec. On retiring from that position he resumed practice. In 1881 and 1886 he was an unsuccessful Conservative candidate for the House of Commons. In 1908 he was elected for a Montreal constituency and actively supported Robert Laird Borden (q.v.), the Conservative leader, in opposing the Liberal policy of reciprocity with the United States. After the defeat of the Laurier administration, in 1911, Doherty was appointed Minister of Justice in Premier Borden's cabinet.

**DOHERTY, HENRY LATHAM** (1870- ). An American operator of gas and electric companies, born at Columbus, Ohio. He became an office boy for the Columbus Gas Company when only 12 years old, advanced rapidly through various positions, and between 1890 and 1905 was engineer or manager of gas, electric, or traction companies in 29 cities. In 1905 he organized Henry L. Doherty & Co., of New York City, bankers and operators of public-utility corporations. He patented several combustion processes and various pieces of apparatus, was awarded the first Beall gold medal in 1898 by the American Gas Light Association for a paper on "Gas for Fuel," and was president of the Northwestern Electric Association (1899), the National Electric Light Association (1901), and the Ohio Gas Light Association (1902), and vice president of the American Gas Institute (1908).

**DOHERTY, ROBERT REMINGTON** (1848- ). An American theologian and author. He was educated at Dickinson College, Pa., and at Grant University, Tenn. He wrote on religious topics, especially for Sunday schools. His principal works include: *A Guide to the Study of the International Lessons*, an annual publication (jointly with Dr. J. L. Hurlbut and Dr. T. B. Neely, 1891-1901); *Representative Methodists* (1888).

**DOHM, dōm, ERNST** (1819-83). A German humorist. He was born at Breslau and studied theology and philosophy at Berlin and Halle. He was editor of *Kladderadatsch*, one of the leading humorous political publications of Germany, from 1849 until his death and took high rank as a master of political satire. He translated the *Fables* of Lafontaine into German (illustrated by Gustave Doré, 1876-77) and published poems, comedies, and farces, of which *Das erste Debit* (3d ed., 1860) was probably the most popular.

**DOHNANYI, dō'nōn-yé, ERNST VON** (1877- ). A Hungarian pianist and composer, born in Pressburg. He studied at the Royal Conservatory in Budapest (1894-97), where several of his compositions received prizes. For two months during the summer of 1897 he studied with D'Albert, and in the autumn of the same year began a successful concert tour of the principal cities of Germany, and England. Beginning in March, 1900, he made a successful concert tour in America and returned in October, 1900, for another tour. He played, with the Boston Symphony Orchestra, his pianoforte concerto in E minor (Rosendorf prize composition, Vienna, March, 1899) and composed, besides that work, a second piano

concerto in Db, an overture *zriny*, a concert-stück for 'cello and orchestra, piano pieces, chamber music, and two symphonies, which show a decided talent for the larger forms. A comic opera, *Tante Simona*, was produced with success in Berlin (1913).

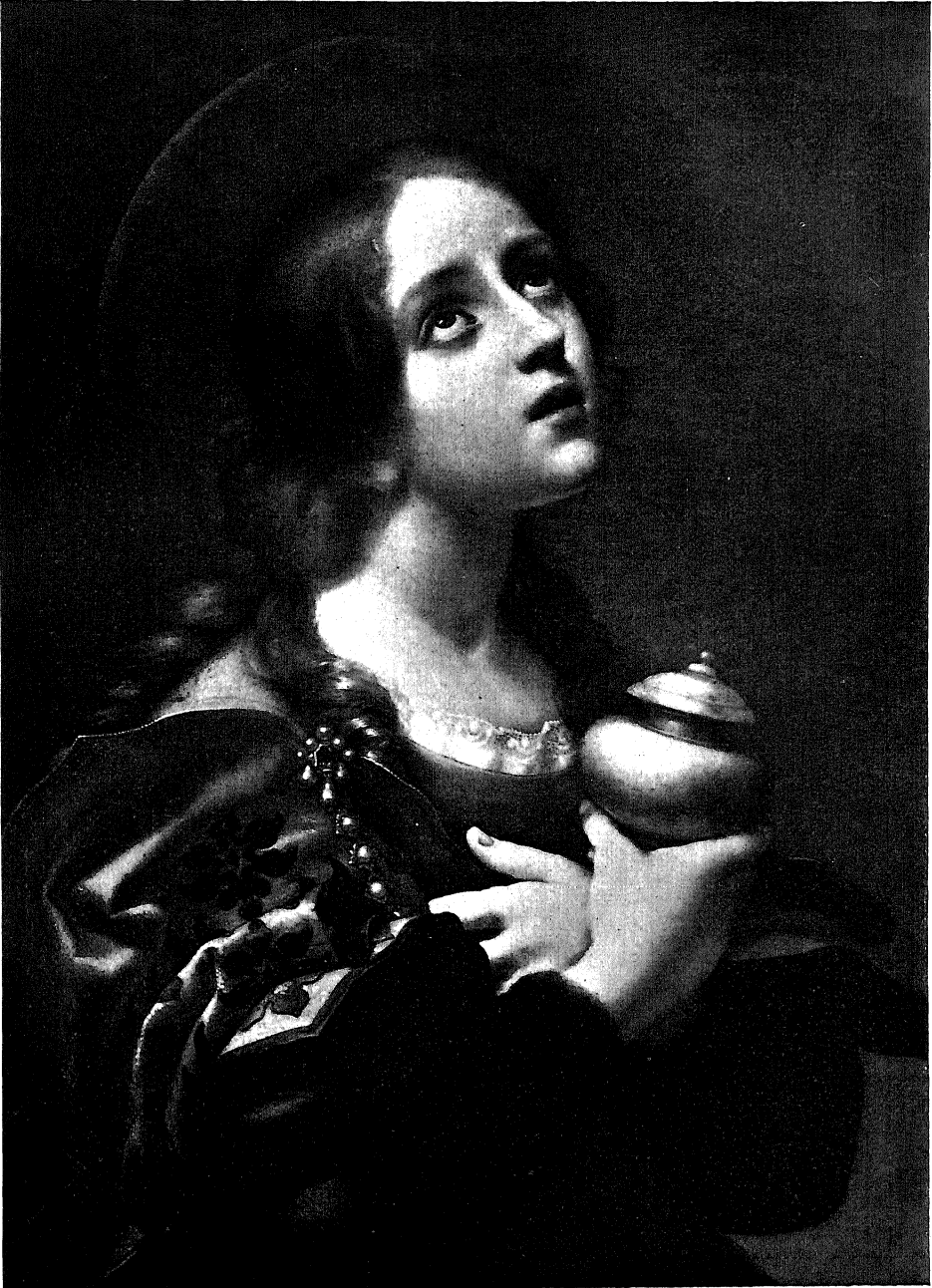
**DOHRN, dōrn, ANTON** (1840-1909). A German zoölogist, son of Karl August Dohrn, born in Stettin. He studied the natural sciences under Haeckel in Jena, where he subsequently became privatdocent. He was also for several years interested in the investigation of marine animals, especially crustaceans, and made excursions to the coast of England and to the Mediterranean for the purpose of studying them. In 1870 he founded the Zoölogical Station at Naples, the first and most important institution of its kind. (See ZOÖLOGICAL STATION.) He has written *Der Ursprung der Wirbelthiere* (1875); *Studien zur Urgeschichte des Wirbelthierkörpers* (1882).

**DOHRN, KARL AUGUST** (1806-92). A German entomologist. He was born in Stettin, educated in Berlin, and traveled extensively. In 1842 he became president of the Entomological Society of Stettin (the first to be established in Germany) and editor of the *Entomologische Zeitung*. From 1846 to 1866 he was engaged in the publication of the *Linnae Entomologia*, a work of sixteen volumes. He was one of the most distinguished coleopterists of his time.

**DOK'ANA** (Gk. τὰ δόκανα, from δόκος, dokos, beam). A rude Spartan symbol formed by two upright beams crossed by other beams. It was of very ancient origin, and was probably the representation of the Dioscuri, considered as gods of war, which the Spartan generals took with them in the field.

**DOKO, dō'kō**. A term applied generally to dwarfish tribes of Central Africa; pygmy. Consult Keane, *Man, Past and Present* (Cambridge, 1899).

**DOL'ABELLA, PUBLIUS CORNELIUS** (c.70-43 B.C.). A Roman of patrician family, and of profligate character. Though involved in criminal charges, he was defended and protected by Cicero; and in 49 B.C. he put away his wife Fabia that he might sue for the hand of Cicero's daughter Tullia, whom he married, notwithstanding the orator's opposition. The recklessness of Dolabella plunged him always deeper into debt, until in a short time, driven from Rome by the demands of his creditors, he took refuge in Caesar's camp and was assigned to the command of a fleet. He took part, but without distinction, in the battle of Pharsalus, and then returned to Rome, hoping to be enriched from the spoils of Caesar's victories, but in this he was disappointed. Accordingly he had himself adopted into a plebeian family and secured the tribuneship, when he audaciously proposed a law that all debts should be legally canceled; this proposal led to long and bloody contests. Caesar gave him appointments in his African and Spanish campaigns. On the death of the dictator Dolabella seized the consular insignia and allied himself with the conspirators. He was, however, soon won over by Antonius, who made him governor of Syria. He caused at Smyrna the death of the proconsul, C. Trebonius, who had withstood the extortion which marked his coming to his province. At length, when Cassius besieged him in Laodicea, to avoid capture he ordered a soldier to kill him (43 B.C.).



CARLO DOLCI  
"THE MAGDALEN," FROM THE PAINTING IN THE UFFIZI GALLERY, FLORENCE





**DOLA'BRA** (Lat., from *dolare*, to hew). The Roman name for an implement used by soldiers in cutting wood, building palisades, or tearing down walls, or as a battle-axe; by the husbandmen for breaking up the soil or trimming trees; and, finally, at sacrifices. It seems to have had a long handle of wood, to which was attached a head having a sharp hatchet blade on one side and a slightly bent pick on the other. A smaller form was called *dolabella*.

**DOLBEAR**, dōl'bēr, AMOS EMERSON (1837-1910). An American inventor and teacher. He was born in Norwich, Conn., and graduated from the Ohio Wesleyan University in 1866. In 1874 he became professor of physics at Tufts College (Mass.). He made several important inventions and researches in connection with the writing telegraph (1864), the electric gyroscope (1867), the magnetophone (1876), the static telephone (1879), wireless telegraphy (1881), and photographing with electric waves (1893). In 1873 he announced the convertibility of sound into electricity. His works include: *The Art of Projecting* (1876; 1888); *Matter, Ether, and Motion* (1892); *The Machinery of the Universe* (1897).

**DOLCE**, dōl'chā, LODOVICO (1508-66). An Italian author, born in Venice. He is a typical representative of the diffuse culture of the Italian Renaissance. He was prolific as a writer of comedy of classic character, of translations (especially of Horace), or criticism and philology (*Osservazioni nella volgar lingua*), of history and poetry. Consult Salza, *Delle commedie di L. D.* (Melfi, 1899).

**DOLCI**, dōl'chē, CARLO (1616-86). A Florentine religious and portrait painter. He was born May 25, 1616, and at the age of 14 painted a portrait of himself, especially good in color, now in the Pitti Gallery. Although a pupil of Jacopo Vignali (q.v.), he did not follow the general tendency of the Mannerists, but finished his works very carefully. He confined himself chiefly to small canvases of a religious nature, usually representing a single figure, half figure, or head. His colors are not without harmony, but their effect is marred by heavy, dark shadows, and the surface of his pictures is almost as smooth as porcelain. His work is chiefly characterized by its religious sentimentality. Among his best paintings are his own portrait at the age of 56 and that of the "Archduchess Claudia," both in the Uffizi (Florence); "Christ Blessing the Bread and Wine," Cathedral of Pistoja; "Ecce Homo" in the Pitti; "St. Cecilia," Dresden Gallery; the famous "Magdalen" at Munich, and many other representations of this last subject. His works may be best studied in the Uffizi and Pitti galleries and in the Corsini Palace in Florence. One of his few pictures painted life-size, the "Virgin Appearing to St. Louis, Bishop of Toulouse" (Uffizi), shows his incapability of treating larger subjects. His works were often repeated by himself, and especially by his daughter and pupil Agnese, and have been frequently engraved. He died in Florence, Jan. 17, 1686. Consult Baldinucci, *Notizie del professori del disegno* (Florence, 1728-1846), and special edition of the *Life of Dolci* (ib., 1886). The latest publication, Hay, *Carlo Dolci* (London, 1908), is full of errors.

**DOL'CINITES**, or **DUL'CINISTS**. The followers of Dolcino. See APOSTOLIC BRETHREN.

**DOLDRUMS** (apparently a quasi-Lat. form

of dialectic Eng. *dold*, *dolt*, really p.p. of *dull*, to stupefy, from *dull*, AS., OS., *dol*, Ger. *toll*, stupid, mad). A name given by sailors to that part of the ocean near the equator in which calms and light baffling winds prevail with hot, sultry air, local squalls, thunder, and rain. In the doldrums sailing vessels beat about for weeks and they were formerly the dread of those vessels that had to cross the equator. The sailing directions and charts published by Maury were the first to give comprehensive directions for avoiding those parts of the ocean most troubled by the doldrums. The doldrums proper oscillate north and south of the equator with the season of the year. They lie farthest north in July, August, and September, and farther south in January, February, and March. In the Atlantic Ocean in February, the region having most characteristic doldrums extends between the equator and lat. 5° N. and between long. 50° and 30° W., whereas in August it extends between lat. 5° and 10° N. and long. 30° and 45° W. In the Pacific Ocean, in January, the doldrum region extends, with but few interruptions, between the equator and lat. 15° S. and from long. 130° E. eastward to long. 145° W. In July it extends over two regions somewhat separated from each other, viz., from lat. 10° N. to lat. 10° S., and from long. 130° to 165° E., and again from long. 145° to about 80° W., and from lat. 5° to 15° N. The region of the doldrums is characterized by the highest temperatures and moistures, coupled with the feeblest winds that occur anywhere on the ocean; the ocean surface in these regions is of a glassy smoothness, often bearing a thin layer of oil and waste left by passing vessels and floating for a long time on the surface. An irruption of cool air into the doldrums has been suggested as the initial step in the formation of a rainy region in which develop the West Indian hurricanes. Although there is but little horizontal motion of the air within the doldrums, yet there appears to be considerable vertical motion. The doldrum region lies between the region of northeast and southeast trade winds and is the apparent starting point of the great upper currents that are supposed to flow from the equatorial regions north and south towards either pole.

**DÔLE**, dōl. The capital of an arrondissement in the Department of Jura, France, 25 miles southeast of Dijon (Map: France, N., L 5). It is picturesquely situated on a vine-clad slope rising from the right bank of the river Doubs and the Rhône-Rhine Canal and overlooking the forest of Chaux. The surrounding country is laid out in gardens and promenades. Its principal buildings are the church of the Cordeliers; church of Notre Dame, a Gothic edifice of the sixteenth century; the college, with an art gallery, founded by the Jesuits; the Hôtel Dieu; the barracks; the Palais de Justice, occupying a fourteenth-century convent; and the Tower of Vergy, now used as a prison. Public institutions include a college, an agricultural society, a school of design, an art gallery, and a public library of 40,000 volumes. The chief manufactures are hosiery, tiles, pottery, chemical products, and beer; there are also iron-smelting furnaces, foundries, machine shops, distilleries, and flour mills. The city carries on some trade in corn, wine, wood, marble, and iron. Pop., 1901, 14,627; 1911, 16,294. Dôle was a Roman station and garrison town. It

belonged to the dukes of Burgundy and resisted with great spirit the efforts of Louis XI to annex it in 1479. It became the capital of Franche-Comté at the beginning of the fifteenth century, and part of France in 1678. It is the birth-place of Pasteur.

**DOLE, CHARLES FLETCHER** (1845- ). A Unitarian clergyman. He was born at Brewer, Me., and graduated at Harvard in 1868 and at Andover Theological Seminary in 1872. He was professor of Greek at the University of Vermont in 1873, and in 1876, after two years as pastor of the Plymouth Church of Portland, Me., became minister of the First Congregational Church of Jamaica Plain, Boston. His works include: *Early Hebrew Stories* (1886); *The Golden Rule in Business* (1895); *A Catechism of Liberal Faith* (1895); *The Coming People* (1897); *The Theology of Civilization* (1899); *The Religion of a Gentleman* (1900); *The American Citizen* (1902); *The Hope of Immortality* (1906); *The Ethics of Progress* (1906); *The Coming Religion* (1910); *The Burden of Poverty* (1912).

**DOLE, NATHAN HASKELL** (1852- ). An American editor, translator, and author, born at Chelsea, Mass. He graduated at Harvard University in 1874 and was for some time active as a writer and journalist in Philadelphia, New York, and Boston. He translated, notably: many of the works of Tolstoi, and books of other Russians; novels of the Spaniard Valdés (1886-90); a variety of works from the French and Italian. His editorial labors, varied and extensive, include: *Omar Khayyám* (1896); *Tolstoi's Collected Works* (20 vols., 1899); *Poetical Works of Keats and Shelley* (1905); *Vocations* (10 vols., with William DeWitt Hyde and Caroline Ticknor, 1909-10). Among his original writings are: *A Score of Famous Composers* (1891); *The Hawthorne Tree and Other Poems* (1895); *Joseph Jefferson at Home* (1898); *Life of Count Tolstoi* (1911); *The Spell of Switzerland* (1913).

**DOLE, SANFORD BALLARD** (1844- ). An Hawaiian statesman. He was born in Honolulu, the son of American missionaries, graduated at Williams College, and was admitted to the bar in Boston. He was judge of the Supreme Court of Hawaii from 1887 to 1893. On the overthrow of the kingdom in 1893 he became President of the provisional government and in 1894 was elected President of the newly established Hawaiian Republic, to hold office until 1901. President Cleveland's intention of restoring constitutional authority to Queen Liliuokalani was defeated by the action of President Dole. In 1898 he was appointed on the commission for recommending legislation regarding Hawaii to the Congress of the United States, and in 1900, after the annexation, he was Governor of the Territory of Hawaii until 1904, when he was appointed United States Judge of the Territory.

**DOL'ERITE.** See BASALT.

**DOLES, FUNERAL.** See MORTUARY CUSTOMS.

**DOLET, dō'lā', ETIENNE** (1509-46). A noted French scholar and printer. The legend which represents him as the illegitimate son of Francis I is absolutely without foundation, since the future King of France was not yet 15 years of age when Dolet was born. He was born at Orléans, studied in Paris, Padua, and Venice, where he became secretary to Jean de Langeac, Ambassador of France to the Republic

of Venice. At the early age of 21 he was already planning his great work on the Latin language, and with that end in view he followed the courses on Lucretius and Cicero given at Padua by Egnatius and Simon de Villeneuve. Returning to France in 1530, he began the study of law at Toulouse in 1532, but, becoming involved in a controversy with the authorities regarding the suppression of students' societies, he was imprisoned. Fearing the sentence of death for his utterances on religion, he invoked the intervention of Jean de Pins, Bishop of Rieux, who succeeded in persuading the authorities of the Parlement of Toulouse to limit his punishment to banishment. Arriving at Lyons on Aug. 1, 1534, he became corrector to the presses of the famous printer Sébastien Gryphe. At the age of 25 he already enjoyed great renown as a scholar and Latin poet. In 1535 he undertook the defense of the Ciceronians against Erasmus and others, publishing his *Dialogue on the Imitation of Cicero* (*Dialogus de imitatione Ciceroniana adversum Desiderium Erasmus Roterodamum pro Christoforo Longolio*), and in 1536 issued the first folio volume of his master work, the *Commentaries on the Latin Language* (*Commentariorum Linguae Latinae*). The second volume appeared in 1538, but the last was never published on account of the premature death of the author. On Dec. 31, 1536, Dolet was attacked in the streets of Lyons by a young painter named Jehan Compaign, whom he killed in self-defense. He escaped from Lyons and betook himself to Paris, where he sought the assistance of Pierre Duchâtel, Bishop of Tulle, and Margaret of Navarre, sister of King Francis. Through their efforts a royal pardon was secured for him on the 19th of February following. Returning to Lyons, he was nevertheless imprisoned for a month until the order of liberation was given on the 21st of April. The following year (1538) he secured permission from Francis I to print his own writings for 10 years and established himself at once as a printer at Lyons, issuing important scholarly works in considerable numbers. In 1538 he married Louise Giraud, and the next year he celebrated the birth of his son Claude in a long Latin poem, translated almost simultaneously into French, entitled *Genethliacum Claudii Doleti*. The astonishing prosperity of his presses—in 1542 alone he published almost 40 works—won him the antipathy of his competitors, from which he suffered keenly at times. Probably at their instigation he was arrested in July, 1542, for having translated the Bible into French, as well as for his versification of the Credo, in which he had suppressed the words *communione sanctorum* and had substituted *habeo fidem* for *credo*. His friend Duchâtel again came to his rescue, and succeeded in having him released in October, 1543. Notwithstanding this, the persecutions of the unfortunate printer did not cease, and he was again arrested by the order of the Sorbonne, this time for having mistranslated a passage of the *Axiochus*, then falsely attributed to Plato. He was accordingly taken to Paris, and on Aug. 3, 1546, was branded, tortured, strangled, and burned as an atheist. It was said that he repented in his last moments, but there is no proof to substantiate this assertion. He was also considered by some as a Huguenot martyr, but without any foundation, for Calvin accused him of heresy. The minutes of

Dolet's trial were printed by Taillandier in 1836 (*Procès d'Etienne Dolet*) from the registers of the Parlement of Paris. On the first Sunday of August of each year the anticlerical party is accustomed to hold a demonstration before the statue of Dolet, which is located in the Place Maubert, where he was burned. Consult: Boulmier, *Etienne Dolet* (Paris, 1875); R. C. Christie, *Etienne Dolet, the Martyr of the Renaissance* (London, 1899); Galtier, *Etienne Dolet* (Paris, 1907); Firmin-Didot, *Essai sur la Typographie* (ib., 1852); Baudrier, *Bibliographie lyonnaise*, vol. viii (Lyons, 1910).

**DOLGELLY**, döl-géth'le (Welsh, dale of hazels). A market town and the capital of Merionethshire, North Wales, on the Wnion, about 60 miles southwest of Chester (Map: Wales, C 4). It lies in a rich and picturesque valley, at the foot of Cader Idris, and during the summer months is much frequented by English and foreign tourists. It is celebrated as the place where Owen Glendower held his Parliament in 1404 and signed his treaty with Charles VI of France. It has manufactures of coarse woollens and flannels. Pop., 1901, 2437; 1911, 2160.

**DOLGEVILLE**. A village in Fulton and Herkimer counties, N. Y., 30 miles east of Utica, on the New York Central Railroad, and on East Canada Creek, which develops considerable water power (Map: New York, F 4). It contains two fine natural parks and a public library. Dolgeville is the centre of the felt shoe industry, which originated here, and has a large piano-sounding-board factory, flour mills, and a tannery. The water works are owned by the village. Pop., 1900, 1915; 1910, 2685.

**DOLGORUKOVA**, döl'gö-röök'ö-vä, EKATERINA MIKHAILOVNA, PRINCESS YUREVSKAYA (1846- ). The favorite of the Russian Czar Alexander II, who contracted a morganatic marriage with her in July, 1880, after the death of his wife. She bore him a son, Prince Georgiy Yurevsky (1873), at present in the Russian navy, and two daughters. After the assassination of the Czar she removed to Switzerland, and in 1892 published at Geneva, under the pen name of Victor Laferté, *Alexandre II, Détails inédits sur sa vie intime et sa mort*.

**DOLGORUKY**, döl'gö-röök'ö, PETER VLADIMIROVITCH (1807-68). A Russian author, born in Moscow. His *Notice sur les principales familles de la Russie* (published under the name of D'Almagro, 1843) caused his temporary banishment by Czar Nicholas I. This work formed the basis for his *Russian Genealogy* (4 vols.) published under his own name at St. Peter-burg in 1854. Upon the appearance of his *La vérité sur la Russie* (1860) he was finally exiled from Russia for life. His *Mémoires* (1867-71) contain much of interest regarding many notable personages of his day.

**DOLICHOCEPHALY**, döl'i-kö-séf'a-li. See ANTHROPOMETRY.

**DOLICHOS**, döl'i-kös (Neo-Lat., from Gk. δολιχός, *dolichos*, long, on account of the long pods). A genus of plants of the family Leguminosæ, closely allied to *Phaseolus* (see KIDNEY BEAN), from which it is distinguished by the extension of the base of the standard so as to embrace the wings of the corolla at their base. The genus includes a considerable number of species—some shrubby, some annual, and some perennial herbaceous plants. Some have beautiful flowers, and some of the herbaceous species

are cultivated on account of their seeds, which afford a kind of bean; or of their young pods, which, like those of the kidney bean, are boiled for the table. The more important species are *Dolichos lablab*, a native of India and Egypt; *Dolichos lubia*, a native of Egypt; *Dolichos sesquipedalis*, a native of America; and *Dolichos biflora* (horse gram), native in India; *Dolichos sphaerospermus* (calavana, or dark-eyed pea), a native of the West Indies. In the climate of Great Britain even the most hardy kinds require the aid of a little artificial heat, and they are reckoned inferior to other kinds of beans or garden vegetables of easier cultivation. The soy bean, *Vigna sinensis* or *Soja hispida*, was formerly referred to this genus. The well-known Japanese sauce or ketchup called soy is made from the soy bean. Allied to *Dolichos* is the genus *Canavalia*, to which belong the sword and Jack beans of India. *Canavalia ensiformis* (Jack bean), the commonly cultivated species, has pods about a foot long with white seeds. The sword bean is *Canavalia gladiata*, and most varieties have red seeds. Another allied genus is *Psophocarpus*. The seeds of *Dolichos tetragonolobus* are used in the Mauritius as beans are in America, and its pods and tuberous roots are common Indian esculents. Some species of *Pachyrhizus*, also an allied genus, are remarkable for their tuberous roots, as *Pachyrhizus angulatus*, a native of India, now cultivated in South America and other warm countries for its pleasant, turnip-like tubers; and *Phaseolus trilobus*, which has tubers 2 feet long and nearly cylindrical, much used as a boiled vegetable in China and Cochinchina. See BEAN.

**DOLICHOS**. See OLYMPIC GAMES.

**DOLIUM** (Lat., large jar). A genus of gastropod mollusks. See TUN SHELL.

**DOLLUM**. See VASE.

**DOLL** (probably from *Doll*, abbreviation of *Dorothy*). A figurine, especially a baby, which has always been a favorite toy for girls. Dolls have been used from the earliest times and among all nations, barbarous as well as civilized, because such tastes and desires spring from that love of nursing and fondling infants implanted by nature in the female character. The manufacture of dolls is and has always been an industry carried on in the rural districts of continental Europe, chiefly by the peasants in their homes. Factories for the manufacture of dolls have been introduced into England and America, but the extreme cheapness of peasant labor and the wonderful skill acquired by successive generations in the art of doll making still enable this hand-made product to compete successfully with the output of the factory. As in the case of most other toys, dolls were at one time imported into Great Britain chiefly from the Netherlands, and hence not an unusual name for a doll was "a Flanders baby." These old Flemish or Dutch dolls were made of wood, with neatly formed faces and flashy dresses, the cheaper kinds having slender wooden legs. Most of the dolls made about 1860 were the long, slender, kid or cloth bodied dolls, with heads of papier-maché or china. Next came the beautiful wax dolls, with natural ringlets, eyes that open and shut, and apparatus inside by which they could be made to squeak and sometimes say "Papa" and "Mamma."

These dolls, though very beautiful, were both expensive and perishable and are no longer manufactured. Later came the wooden-bodied,

jointed dolls. These were invented by a Frenchman called Jumeau and for a time were made wholly in France; but a jointed doll equally good, though less costly, is made in Germany. China and bisque heads of dolls are made in little village factories in continental Europe, the manufacture being limited by the village authorities on account of the smoke nuisance which it creates. Papier-maché and other composition heads are usually molded at home. In making dolls the work is divided among the members of the household, the father molding the different parts of the doll, the mother painting them and making the wigs, while the children put the parts together. After completion the dolls are taken to a general collecting house.

The manufacture of rubber dolls is a branch of the industry which is chiefly carried on in large factories. A development is the modern rag baby, a doll made from printed cloth and stuffed into the well-rounded form of a baby. This form of doll, printed in bright colors, is largely made in America. In part the place of dolls was at one time taken by figures of animals made from stuffed plush in the form of so-called "Teddy-bears," which at one time enjoyed a vogue in the United States. Dolls follow various fashions, and one form or design may have its vogue only to be supplanted as another fancy may dictate.

**DOLLAR.** The unit of value in the monetary systems of the United States and Canada. The name itself is derived from Joachimsthal, in Bohemia, where the counts of Schlick in the fifteenth century struck large coins of silver from the metal found in the neighborhood. These were known as *Joachimsthaler*, or, by abbreviation, *thaler*, from which, through the Low German *daler*, the word "dollar" is derived.

Among the multitude of coins which prevailed before the nineteenth century certain issues came to be regarded as standard by reason of the excellence of their manufacture and became international coins of wide circulation. It was thus that a valley in the recesses of the Bohemian mountains gave the name to the monetary unit of Prussia before the establishment of the German Empire, and to that of the United States, Canada, Mexico, and other countries. Somewhat similar is the derivation of the term "florin," familiar in the Netherlands and Austria, and represented in the English coinage, from coins manufactured in the Middle Ages in Florence.

The American dollar, established by the Coinage Act of 1792, was taken from the Spanish dollar in circulation in the Colonies, corresponding to the average weight of the dollar, as slightly less than the legal weight. While the dollar, since 1792, has been the unit of value in the United States, it was, prior to 1873, but little represented by coins of this denomination. The silver dollar, by the Act of 1792, weighed 416 grains and had a fineness of .8924. This weight was changed by the Act of Jan. 18, 1837, to 412.5 grains, .900 fine, at which it still remains. Under the Act of 1873 *trade dollars*, weighing 420 grains each, of limited legal tender, were coined, in order to facilitate trade with China and Japan. Prior to 1873 only 8,031,238 dollars were coined. Large amounts of the half-dollars which were then exactly half the size of the dollar, were, however, coined. Further coinage of the silver dollar was author-

ized by the acts of Feb. 28, 1878, and July 14, 1890. Gold dollars, weighing 25.8 grains, with a fineness of .900, were authorized to be coined by the Act of March 3, 1849, and over 19,000,000 were thus coined before the coinage was discontinued (Sept. 26, 1890). By the Act of March 14, 1900, the gold dollar was declared to be the standard of value in the United States, but no provision was made for the issue of a coin corresponding to the unit. See MONEY.

**DOLLARDEE'** (probably from *dollar*, on account of the color). A local name, in Kentucky, for the blue sunfish (*Lepomis pallidus*). See SUNFISH; and Plate of DARTERS and SUNFISH.

**DOLLARFISH** (so called on account of the color and shape). A local name in Maine for the butterfish (*Stromateus triacanthus*).

**DOLLART**, *dol'ärt*. A shallow, nearly landlocked inlet of the North Sea at the mouth of the river Ems, between the Prussian Province of Hanover and the Dutch Province of

(Map: Netherlands, F 1). It is about in length by 7 in breadth and was formed by inundations of the sea, the first of which took place in the latter half of the thirteenth century and the last in the sixteenth century. By these watery inroads a large number of villages were submerged and thousands of persons perished. A part of the land has been reclaimed, especially on the Dutch shore.

**DÖLLINGER**, *döl'ling-ër*, JOHANN JOSEPH IGNAZ VON (1799-1890). A distinguished German Roman Catholic historian. He was born at B. . . . Feb. 28, 1799. He was educated there and at the University of Würzburg, where his father was professor of anatomy and physiology. He was ordained a priest in 1822. In 1823 he became a teacher at Aschaffenburg; in 1826, professor of church history and ecclesiastical jurisprudence in the newly established University of Munich, and began an extraordinary career as historian, publicist, disputant, and counselor. His first book, *Die Lehre von der Eucharistie in den ersten drei Jahrhunderten* (1826), was written at Aschaffenburg. In 1828 he published a history of the Reformation as the continuation of Hortig's *Handbuch der Kirchengeschichte*. In 1832 he was appointed *defensor matrimonii*. (See DEFENDER OF THE MARRIAGE TIE.) In 1833-35 he published a *Geschichte der christlichen Kirche*, and in 1836-38 the *Lehrbuch der Kirchengeschichte*. Neither of these works was carried to completion; they are combined in the English translation, *A History of the Church* (1840-42). In his next work, *Die Reformation, ihre innere Entwicklung und ihre Wirkungen im Umfange des lutherischen Bekenntnisses* (1846-48), he gathered . . . he could find unfavorable to the . . . their work. *Luther, eine Skizze* (1851), also belongs to this period. For a time he undertook the duties of the chair of dogmatic theology and lectured on "The Philosophy of Religion," on "Symbolism," and on "Patristic Literature." He was a frequent contributor to the *Historisch-politische Blätter* and published several pamphlets on subjects of occasional interest. He was one of the chief contributors to the first edition of Wetzler and Welte's *Kirchen-Lexicon*, in which his articles on Luther, on Bossuet, and on Duns Scotus attracted much attention. In 1845 he was chosen to represent the University of Munich in the Bavarian Chamber; but, being deprived of his

professorship in 1847, he lost his seat. In the Parliament of Frankfurt in 1848-49 he was recognized as the leader of the Roman Catholic party and fought for the unconditional freedom and independence of the church. In 1849 he was restored to his professorship and also to his place in the Bavarian Chamber, which he held until 1852. Up to this time Dr. Döllinger had been an ardent defender of Catholicity and a bitter opponent of Protestantism. From now on, however, influenced by his historical studies, his attitude began to change and tended more to liberalism. This change dates particularly from a visit to Rome in 1852. Works in which it is evident are: *Hippolytus und Kallistus, oder die römische Kirche in der ersten Hälfte des dritten Jahrhunderts* (1853); *Heidenthum und Judenthum, Vorhalle zur Geschichte des Christenthums* (1857; Eng. trans., *The Gentile and the Jew in the Courts of the Temple of Christ*, 1862), a masterly survey of the condition of the world at the birth of Jesus; *Christenthum und Kirche in der Zeit der Grundlegung* (1860). In 1861 Dr. Döllinger delivered two addresses at Munich which were represented as hostile to the temporal sovereignty of the Pope and brought upon him much criticism. To explain and justify his position he published *Kirche und Kirchen, Papstthum und Kirchenstaat* (1861), a comparative survey of the condition of the non-Catholic communions and of the church, and also a résumé of the history and condition of the Papal States, while the temporal sovereignty was the means providentially established for maintaining the spiritual independence of the papacy, yet it was by no means essential, that the papacy long existed without it, and that, even if it were overthrown, Providence would devise other means of attaining the same end. The second part was a criticism of the administration of the Papal States, which gave dissatisfaction to the authorities, as being, though well meant, inopportune and therefore unfriendly. *Die Papstfabeln des Mittelalters* (1863), and an address delivered at Munich the same year, *Vergangenheit und Gegenwart der katholischen Theologie*, were no more acceptable. Similar feelings were aroused by the part taken by Dr. Döllinger in reference to the "Catholic Union." But his ability and learning were unquestioned, and his influence, especially at home, was very great until the approach of the time for opening the Vatican Council. It was understood that the doctrine of the infallibility of the Pope would be a subject of discussion, and Dr. Döllinger was active in organizing opposition. Assisted by his colleague, Friedrich, and others, he wrote articles and letters on the subject for the Augsburg *Allgemeine Zeitung*, which were afterwards collected in book form: *Der Papst und das Konzil* (1869, under the pseudonym Janus), and *Briefe vom Konzil* (1870, under the name Quirinus). On the publication of the decree of the council defining the infallibility of the Pope in all doctrinal teachings on faith and morals addressed *ex cathedra* to the universal Church, Dr. Döllinger refused to accept the doctrine. In August, 1870, he presided over a gathering of theologians at Nuremberg which publicly repudiated the doctrine and formed the germ of the Old Catholic movement. In the organization of the Old Catholic church, however, he took no active part. He was excommunicated by the Archbishop of Munich in April, 1871.

While the sentence was pending, he was elected rector of the University of Munich by a large majority of votes, and after it was pronounced he received honorary degrees from the universities of Oxford and Edinburgh, and was decorated by the King of Bavaria and the Emperor of Germany. Although he ceased to teach theology, he continued to lecture on ecclesiastical history and related subjects. His literary activity was little diminished during this stormy period of his life. Among his later works may be mentioned: *Sammlung von Urkunden zur Geschichte des Konzils von Trient* (1876); *Akademische Vorträge* (1888-91); *Beiträge zur Sektengeschichte des Mittelalters* (1890); *Briefe und Erklärungen über die vatikanischen Dekrete* (1890); *Kleinere Schriften* (1890). With Professor Reusch he reprinted the autobiography of Bellarmine (1887), and prepared a history of recent Roman Catholic ethical discussion as a thrust at the Jesuits, *Geschichte der Moralstreitigkeiten in der römisch-katholischen Kirche seit dem XVI Jahrhundert* (1890). Among his works translated into English are: *Declarations and Letters on the Vatican Decrees*; *First Ages of Christianity*; *Jew and Gentile in the Courts of the Temple of Christ*; *Hippolytus und Kallistus*. He died at Munich, Jan. 10, 1890. Consult: Kobell, *Ignaz von Döllinger, Erinnerungen* (Munich, 1891); Michael, *Ignaz von Döllinger, eine Charakteristik* (Innsbruck, 1893); and particularly the life by Friedrich (Munich, 1899-1901). See OLD CATHOLICS.

**DOLLIVER, JONATHAN PRENTISS** (1858-1910). An American legislator, born in Preston Co., W. Va. After graduating from the University of West Virginia in 1875 he studied law, was admitted to the bar in 1878, and began practice at Fort Dodge, Iowa. As an orator he first attracted attention in the Blaine campaign of 1884. He was a member of Congress from 1889 to 1900, was appointed United States Senator to fill out an unexpired term, and was elected to the Senate for the terms 1901-07 and 1907-13. He was early associated with the conservative Republicans in the House of Representatives, where he was one of the framers of the Dingley Tariff Bill in 1897. During his later years in the Upper House, however, he became known as a leader among the "insurgent" Senators, and he and his associate, Senator Cummins, were perhaps the most aggressive opponents of the tariff and administration policies. One of the finest public speakers of his day, Senator Dolliver was particularly effective in his attacks (1909-10) upon the Payne-Aldrich Tariff Bill.

**DOLLIVER ROMANCE, THE.** A novel which Nathaniel Hawthorne engaged himself to contribute to the *Atlantic Monthly*, but which his last illness rendered him unable to complete. The first installment appeared in that magazine, July, 1864.

**DOLLOND, JOHN** (1706-61). A distinguished English optician, inventor of the achromatic object glass for telescopes. He was the son of a silk weaver in humble circumstances who had come to London as a French refugee. Dollond followed his father's occupation, but was also able to devote himself to the study of mathematics, optics, and astronomy. In addition he made himself acquainted with anatomy and theology, and went so far in the study of the classical languages as to translate the Greek Testament into Latin and was also able to read

French, German, and Italian. He apprenticed his eldest son, Peter (1730-1820), to an optician; and after the latter had established himself in business on his own account, he was joined by his father in 1752. John Dollond now devoted himself to the improvement of the refracting telescope, in which work he was encouraged by the most distinguished scientific men of the time. After a series of well-contrived experiments and researches, commenced in 1757 and carried on for several years, he succeeded in constructing lenses where a concave lens of flint glass was combined with a convex lens of crown glass with the result that images were produced without any colored border. (See *ACHROMATISM*.) This was undoubtedly the greatest improvement that the telescope had received since its first invention. The memoir (published in the *Philosophical Transactions* for 1758) in which he gave an account of his investigations was rewarded by the council of the Royal Society with the Copley medal. In 1761 Dollond was appointed optician to the King and was elected a fellow of the Royal Society. His two sons continued to carry on the business with great success. Consult Kelly, *Life of John Dollond* (London, 1808).

**DOLL'S HOUSE, A.** The English version of *Et Dukkehjem*, a play by Henrik Ibsen (q.v.), produced in Christiania in 1879 and in London in 1889. The theme is the right of individualism in woman, which is set forth in the disillusioning experience of Nora Helmer, the young wife of a man fettered by conventional idealism.

**DOLLY VARDEN.** In Dickens's *Barnaby Rudge*, the coquettish daughter of Gabriel Varden, a locksmith, whom she rules completely. She is impulsive, soft-hearted, and full of pretty strategies. Her dainty dress of flowered dimity, cut short enough to show her neat ankles and buckled shoes, gave the name *Dolly Varden* to a style of dress which came into fashion soon after *Barnaby Rudge* was published.

**DOLLY VARDEN TROUT** (from the color, which resembles a *Dolly Varden*, a gown of gay muslin print worn by women about 1865-70). The common brook trout (*Salvelinus malma*), a char of the mountains of western North America, "from the upper Sacramento to Montana, Alaska, and Kamchatka." It has a stout body, large head and mouth, and the back more elevated and less compressed than the Eastern brook trout (*Salvelinus fontinalis*); the tail is almost truncate, and the adipose fin is unusually large. "General color, olivaceous; the sides with round red spots nearly the size of the eye, the back commonly with smaller pale ones, a feature of coloration which distinguishes this species at once from the others." It abounds in the streams of the northern Rocky Mountains, where it is also known as bull trout or red-spotted trout; and in the Far Northwest, where it has the Kamchatkan name "malma"; it descends to the sea and sometimes reaches a weight of 12 pounds. It is one of the most beautiful and active of the Salmonidæ and has been extensively transplanted to waters in the northeastern United States and Europe. See *TROUT*.

**DOLMEN** (Bret., table stone, from *dol*, table + *men*, Welsh *maen*, stone; the Welsh equivalent is *cromlech*, bending slab). The name given to a class of monuments of prehistoric civilization, consisting of several great stone slabs, set edgewise in the earth and supporting a flat

capstone for the roof, designed for a sepulchral chamber. The greatest historic interest attaches to these monuments for several reasons. They were erected in the British Isles, in north-western France, in Spain, along northern Africa, in Syria, and chambered mounds exist as far east as Japan. They mark the Neolithic period in Europe, and their erection may be called the beginning of engineering. In Guernsey and elsewhere they are styled Druid altars and are associated with Druidical rites. By some they have been attributed to the Celts, and this raises the question whether all the dolmen builders of northern Africa and Europe and even in Japan were of the same race. If they were, they would belong rather to the Iberic branch of Sergi's Eurafic species, a strain of whose blood may have reached the Orient. Dolmens were sometimes covered with immense tumuli, and again the earth envelope reached only the capstone. Some of the mounds were of great size, as that of Silbury Hill, Wiltshire, 170 feet high, and 316 feet along the slope. In some of the chambers might have been single interments; in others, says Keane, the same mound had to do duty for many generations, the original cell expanded into the "family vault," developing a system of lateral chambers 30 × 16, and 8 feet high, with roof slabs of corresponding size, some weighing 10, 20, and even 40 tons. Consult Keane, *Ethnology* (Cambridge, 1896), and Borlase, *The Dolmens of Ireland* (London, 1897).

**DOLNYA TUZLA**, dōl'nyā tooz'la. The capital of a district of the same name and a garrison town in Bosnia, Austria-Hungary, picturesquely situated on the Julla, amid mountainous scenery, 38½ miles by rail southeast of Doboï. It is the seat of an Orthodox bishop. It has coal mines, alkali and salt works, a distillery, and saw mills. The salt mines have been worked since the days of the Romans. Pop., about 12,000.

**DOLOMIEU**, dōlō'myē', DEODAT GUY SILVAIN TANCÈRE GRATET DE (1750-1801). A French geologist and mineralogist. He was one of the Knights of Malta when a boy, and fought a duel with and killed a brother knight, for which he was condemned to death, but was saved in consideration of his youth. He then turned his attention to science and visited Portugal, Spain, and Sicily, making interesting observations on the geological structure of the Pyrenees. He minutely described the earthquake in Calabria in 1783 and in later years studied the Alps, where he discovered the mineral "dolomite," which is named after him. He became professor in the Paris School of Mines and a member of the Institute from its formation. In 1798 he was on the scientific staff of Bonaparte's expedition to Egypt. Here he lost his health, and on the way home was left at Messina, where he was an object of political hatred because he had revealed in 1783 to the Grand Master of Malta the designs of the Neapolitans against that island. He was confined in a wretched dungeon, clothed in rags, and given only a bed of straw. There he was kept 21 months. Denied writing materials, he made a pen from a piece of wood, and with the smoke of his lamp for ink, wrote on the margins of his Bible his *Traité de philosophie minéralogique* and *Memoire sur l'espèce minérale*. At the conclusion of the treaty between France and Naples he was released and took the chair of mineralogy at the Museum of Natural History



in Paris. His collections of mineralogy included numerous and valuable specimens. Besides the works mentioned above, he wrote: *Voyage aux îles de Lipari* (1783); *Mémoire sur le tremblement de terre de la Calabrie* (1783); *Mémoires sur les îles Ponces* (1788), etc. Lacépède's *Eloge historique de Dolomieu* is among the *Mémoires* of the Institute for 1806.

**DOLOMITE** (named in honor of the French geologist Dolomieu), BITTER SPAR, or MAGNESIAN LIMESTONE. A calcium-magnesium carbonate that crystallizes in the hexagonal system in forms similar to calcite (q.v.). It is white to reddish or greenish white and sometimes of darker shades, even reaching brown and black in some varieties, with a vitreous and sometimes pearly lustre. Dolomite, both as a mineral and as a rock, is found in various parts of Europe. In the United States it occurs at many localities in Vermont, Rhode Island, New Jersey, New York, and Missouri. It is found both crystallized and massive. The crystallized varieties include the *pearl spar*, which is so called from its lustre. The massive varieties are frequently colored; the variety containing iron is called *brown spar*; the varieties containing manganese and cobalt are reddish. The compact varieties are used as building stones. The Houses of Parliament in London were built from a variety found at Bolsover Moor, and St. Patrick's Cathedral, in New York City, is built from a variety found in Westchester Co., N. Y. Calcined and slaked, dolomite yields a cement offering considerable resistance to the action of water. Calcined dolomite is used as a lining for Bessemer converters (see IRON AND STEEL), and the mineral when treated with sulphuric acid yields calcium and magnesium sulphates and so is used in the manufacture of Epsom salts.

**DOLOMITES** (from the mineral, dolomite, which, in turn, was named from Dolomieu, the geologist). The limestone Alps of South Tirol, between the Adige and Piave rivers. The highest summit, Marmolata, rises to 11,000 feet. Strictly speaking, the term "Dolomite" belongs to the Fassa Mountains, the Langkofel, Rosengarten, and Schlern, but does not apply to the Cristallo, Hohe Gaisl, Tofana, Sorapsis, Antelao, Pelmo, and other peaks of the Ampezzo Limestone Alps; but as these mountains are widely known as the "Ampezzo Dolomites," the popular nomenclature is generally adhered to.

**DOLOO'**. The capital of Mandara (q.v.).

**DOLORES**, dô-lô-râs. A town of the Argentine Republic, in a district of the same name, Province of Buenos Aires, 127 miles by rail from Buenos Aires (Map: Argentina, H 5). It has manufactures of culinary implements. Pop., 1903, 10,000; 1911 (of district), 25,751.

**DOLPH**, dôlf, JOHN H. (1835-1903). An American genre and animal painter, born at Fort Ann, N. Y. He studied in Antwerp under Van Kùyck and in Paris and afterward opened a studio in New York City. He began as a genre painter with such subjects as "The Knickerbocker Farm Yard" (1869), "Beggars" (1874, James Gordon Bennett, Paris), "The Antiquarian" (1876); but later made a specialty of pictures of kittens and puppies, which gained him great popularity. Although always carefully executed in a graceful and spirited manner, their endless repetition prevented the higher development of which his art was capable. He was a member of the National Academy of De-

sign and one of the founders of the Society of American Artists.

**DOLPH**, JOSEPH NORTON (1835-97). An American politician. He was born at Dolphsburg, N. Y., and was educated at Genesee Wesleyan Seminary at Lima, taught school, studied law at Havana, N. Y., and was admitted to the bar in 1861. In 1862 he emigrated to Oregon, crossing the plains as a member of Captain Crawford's "Oregon Escort," a volunteer company authorized by act of Congress to protect emigrants to the Pacific coast. In 1863 he began the practice of law at Portland, Oreg., in partnership with John H. Mitchell, afterward United States Senator. In 1864 he was elected city attorney, and in 1865 was appointed by President Lincoln United States Attorney for the District of Oregon. He served in the Oregon State Senate (1866-68 and 1872-76) and was United States Senator from Oregon from 1883 to 1895.

**DOLPHIN** (OF. *dolphin*, *daulphin*, Lat. *delphinus*, from Gk. *δελφίς*, *delphis*, dolphin). A cetacean of the family Delphinidæ, characterized by the moderate relative size of the head, differing in this from the cachalots, and also usually by having numerous simply conical or nearly conical teeth in both jaws, although some of the species lose those of the upper jaw at an early age. The blowhole is single. The family Delphinidæ includes, along with the dolphins, blackfish, porpoises, grampuses, etc., many animals which on account of their larger size are commonly called whales, as the beluga, etc. The names "dolphin" and "porpoise" are often used interchangeably, but the true dolphins have the snout prolonged into a rather slender beak, which is abruptly separated from the convex forehead, even by a marked furrow; both jaws are furnished with numerous equal teeth. The species are numerous, and none apparently has a very wide geographical range. They are voracious animals, and are said to prey not only on fishes, medusæ, cephalopods, etc., but even on the wounded and feeble of their own species. They live in herds, which often delight the voyager in the ocean solitude by their gambols. Circling about a ship, they display their agility in a thousand graceful motions, now leaping with curved bodies many feet into the air, then darting through a wave with incredible velocity, leaving a slender wake of whitening foam under the water; now the thin back fin only is exposed, cutting the surface like a knife; then the broad and muscular tail is elevated as the animal plunges perpendicularly into the depths.

The common dolphin (*Delphinus delphis*) is found in the Mediterranean and in the northern Atlantic Ocean. It is usually not more than 6 or 8 feet long, but individuals have been seen of 10 feet. The body tapers towards the tail, which is crescent-shaped and about a foot in breadth. The beak is about 6 inches long, and the blowhole crescent-shaped. The color is blackish on the back, grayish on the sides, and satiny white below. The female dolphin brings forth a single young one at a time, which she suckles and nurses with great care. The flesh of the dolphin was formerly considered a delicacy, and sailors still regard the capture of one as a happy event, giving a beeflike alternative to their fare of salted meat.

From the form of its beak the dolphin receives from the French the names of *bec d'oise*



(goose-beak) and *oie de mer* (sea goose). It was very differently regarded and designated by the ancient Greeks, to whom it was *hieros ichthys* (sacred fish), and was invested with many fabulous attributes and was the subject of many mythological legends. It was supposed to be peculiarly friendly to men, perhaps because the dolphin emits a peculiar murmuring or suppressed lowing cry. It was sacred to Apollo, who was worshiped at Delphi with dolphins for his symbols. The figure of the dolphin, therefore, appears on many ancient coins and medals. It is said to have been borne on the shield of Ulysses; early appeared on the shield of some of the princes of France and gave its name to one of the fairest of the French provinces, whence the heir apparent of the French throne came to be styled "dauphin." It is not easy to account for the high regard in which the dolphin was anciently held; nor is it altogether easy to explain the very general transference of its name in modern times to the coryphene (q.v.), a true fish, renowned for those changes of color in its dying moments which poets have delighted to celebrate. Similar attributes are popularly given in Brazil to a dolphin (*Sotalia guianensis*), very abundant in the Bay of Rio de Janeiro, which the natives assert will bring to shore the bodies of drowned persons. This genus (*Sotalia*) has Oriental and African species ascending rivers, one (of the Kamerun River) having the nostrils (blow-holes) prolonged into a snoutlike process.

The European dolphin is rare on the coast of the United States, but three or four other species occur, one of them, at least, numerous. This is the bottle-nosed dolphin (*Tursiops tursio*), which is caught in considerable numbers on the New Jersey coast and also near Cape Hatteras. At the latter place these animals are captured in large seines, sometimes as many as 1000 in one year. Twelve feet is about the maximum size. They produce valuable oil and leather. The oil from the head is of especial fineness and is worth about \$20 a gallon refined. It is used for watches. Closely allied to this species is the "black" dolphin (*Tursiops erebennus*), which is not quite so large and is wholly black in color. The spotted dolphin (*Prodelphinus plagiodon*) is occasionally found on our coasts. It is dark slate-color above, and pale or white below, somewhat spotted with slate. See BLACKFISH. Consult True, *Review of the Family Delphinidae* (Washington, 1899).

**DOLPHIN.** A fish. See CORYPHENE.

**DOMAIN.** See DEMESNE.

**DOMAS Y VALLE**, dō'más ē vā'lyá, José (c.1717-1803). A Spanish naval commander and colonial governor, born at Cartagena. He advanced rapidly and within six years of his admission to the navy attained the rank of chief of squadron. He participated in many engagements in the Mediterranean and was commander of the vessel *Asís* in the West Indies during the war with England (1779-80). During this campaign occurred his brilliant action in capturing treasure ships of the crown, with which he had received for the King, from Vera Cruz to Havana, past the fleet of Admiral Rodney, who knew all about his course, his squadron, and its cargo. After participating in the capture of Pensacola (1781) and later in the siege of Gibraltar, he served as Governor of Panama from 1786 to 1794 and

then became Captain General of Guatemala, and President of its Real Audiencia.

**DOMASZEWSKI**, dō'má-shēf'skē, ALFRED von (1856- ). A German historian. He was born in Temesvár, Hungary, and was educated at the University of Vienna, where he was assistant in the Numismatic Collection (1884-87) and privatdocent. In 1887 he went to Heidelberg as professor of ancient history. He did important work on the corpus of Latin inscriptions, edited, with Dessau, a revision of Marquardt's *Römische Staatsverwaltung*, and wrote on the Roman army, Roman religion, and the history of the Empire: *Fahnen im römischen Heer* (1885), *Religion des römischen Heeres* (1895), *Die Rangordnung des römischen Heeres* (1908), *Abhandlung zur römischen Religion* (1909), *Geschichte der römischen Kaiser* (1909), and, with Brünnow, *Die Provinz Arabia* (1904-09).

**DOMAT**, dō'má', or **DAUMAT**, JEAN (1625-96). A French jurist. He was associated with the recluses of Port-Royal and with Pascal, who bequeathed to him his private papers. His elaborate digest, entitled *Lois civiles dans leur ordre naturel* (3 vols., 1689-94), places him among the first jurists of his century, though it was not until after 1726, when Blackstone commended the work and it was translated into English, that it received any degree of attention outside of France. He also published *Le droit public* (1697) and *Legum Delectus* (1700).

**DOMATIA**, dō-má'shi-á (Neo-Lat. nom. pl., from Gk. δωματίον, *dōmation*, little house, dim. of δῶμα, *dōma*, house). Portions of plants which are modified so as to form chambers in which various organisms, especially fungi or small animals, may dwell. See SYMBIOSIS.

**DOMBASLE**, dōn'bál', CHRISTOPHER JOSEPH ALEXANDRE MATHIEU DE (1777-1843). A French agriculturist, born at Nancy. In 1822 he was appointed director of the agricultural institute at Roville. He invented the plow which bears his name. An important innovation introduced by him was the use of lime in clayey soils. He contributed greatly to the improvement of agriculture in France by his works upon that subject, such as *Essai sur l'analyse des eaux naturelles* (1810); *Calendrier du bon cultivateur* (1821); *Théorie de la charrue* (1821); *Instruction sur la distillation des grains et des pommes de terre* (1829).

**DOMBES**, dōnb. A district of eastern France entirely included within the department of Ain. It is surrounded on three sides by the rivers Saône, Rhône, and Ain, and on the north by the district of Breese. A peculiarity of the district is the clay soil which does not absorb the rainfall, permitting large pools to form. These cover many acres at certain seasons of the year and render the climate very unhealthy. In the past, the entire district has been swept by disease many times, but large drainage works have since been constructed, and certain laws of sanitation laid down. Large numbers of the pools remain, however, and are used for the cultivation of fish. Dombes, Latin *Dumbæ*, was once part of the Kingdom of Arles. In 1402 Louis II formed the Principality of Dombes, and in 1762 it came under the French crown. Area, 440 square miles.

**DOM'BEEY AND SON.** A novel by Charles Dickens, first published serially in 1846.

**DOM BOC.** dōm'bók (AS. book of dreams or

sentences, Lat. *liber judicialis*), or DOOMBOOK. The code of laws compiled by King Alfred chiefly from the West Saxon collection of his own ancestor Ina, but comprising also small portions of the Mercian laws of Offa and of the Kentish collection of Ethelbert, with the supplements of his successors. "Ina's collection," says Dr. Pauli, "was the only one received entire into the Codex, which was chiefly applicable to the condition of the West Saxons. A few articles were admitted here and there from the Kentish and Mercian laws, but research into this matter is not possible, as Offa's book is lost." Alfred made few, if any, original laws, but contented himself with restoring, renovating, and improving those which he found already in existence. The peculiarly Christian character of the King is strongly impressed on this code, which begins with an extract from the Bible: "The Lord spake these words to Moses, and thus said: I am the Lord thy God." Then follow most of the Ten Commandments, some parts of the Mosaic law relating to criminal offenses, and passages from the New Testament, including the Golden Rule. The code was ratified by the Witan, as Alfred expressly informs us. Consult Pauli, *Alfred the Great*, from the German (London, 1857), and Thorpe, *Ancient Laws and Institutes of England* (ib., 1840).

**DOMBROWSKI**, döm-brów'skě, or **DABROWSKI**, JAN HENRYK (1755-1818). A distinguished Polish general, born in Pierszowice, in the District of Cracow. He entered the service of the Elector of Saxony in 1770, but in 1792, on the first symptoms of the insurrection in Poland, proceeded to Warsaw. He took part in the Polish campaigns against Russia and Prussia and exhibited remarkable military talents. In 1796 Dombrowski went to France, where he was commissioned by the Directory to form a Polish legion among his exiled countrymen. The legion signally distinguished itself in the Italian campaign. In the campaign of 1799-1800 Dombrowski gave proofs of remarkable courage. After the Peace of Amiens he became a general of division in the service of the Cisalpine Republic, and after the battle of Jena he was ordered by Napoleon (1806) to summon his countrymen to arms. His entrance into Warsaw at the head of the Polish divisions resembled a classical triumph. At Dirschau and Friedland he won fresh laurels. In the fatal Russian campaign of 1812 he commanded one of the three divisions of the Fifth Army Corps and at the passage of the Beresina saved from destruction the relics of Poniatowski's corps. In 1813, at the head of his Poles, he took an honorable part in the battles of Teltow, Grossbeeren, Jüterbogk, and Leipzig. After the fall of Napoleon Dombrowski returned to Poland, and in 1815 was appointed by Alexander I a general of cavalry and a Polish senator, but in the following year he withdrew from public employment to his estate at Posen. He died June 6, 1818. Consult Thodzko, *Histoire des légions polonaises établies sous le commandement du général Dombrowski* (Paris, 1829).

**DOMBROWSKI**, JAROSLAW (1835-71). A Polish Socialist, agitator and revolutionist. He was born at Zlatomir, Volhynia, and entered the academy of the general staff at St. Petersburg in 1848. In 1860 he left the government service and participated in Garibaldi's advance

on Naples. In 1864, owing to his complicity in the insurrection at Warsaw, he was condemned by the Russian government to 15 years' imprisonment at hard labor and was transported to Siberia. Before arriving at his destination, however, he escaped and fled to Paris (1865). On the outbreak of the War of the Commune, March 18, 1871, he was appointed commander in chief of the Communist forces stationed at Asnières by the central committee of the National Guard. In the following month he succeeded to the chief command of the entire revolutionary forces; but, after fighting at Neuilly and Montmartre, he was killed by the government troops while defending the barricade at the Boulevard Ornano.

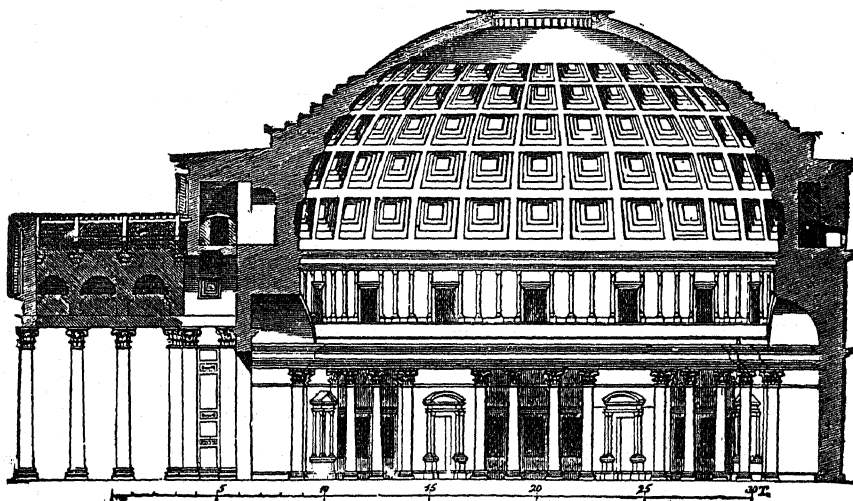
**DOMDANTEL**. An immense submarine cavern near Tunis; a seminary for the black arts, introduced in the continuation of the *Arabian Tales*. Southey narrates its final destruction in *Thalaba*.

**DOME** (OF. *dome*, Fr. *dôme*, from Lat. *domus*, Gk. *δῶμος*, OChurch Slav. *domŭ*, Skt. *dama*, house; connected ultimately with OHG. *zimbar*, Ger. *Zimmer*, Icel. *timbr*, AS., Eng. *timber*; the word is also influenced by Lat. *doma*, Gk. *δῶμα*, house). A term in architecture bearing a twofold meaning. It is loosely used, after the fashion of the German *Dom* and Italian *duomo*, to designate a cathedral or some other building of importance, but its only genuine English scientific meaning is that of a convexly curved vault or roof having a circular or polygonal (or rarely elliptical) plan. It may be of any material—wood, stone, metal, earthenware, etc. It may be built of a single thickness or with two or even three shells; it may spring directly from the substructure, or be raised upon a high drum; it may be of low curvature, like that of the Pantheon at Rome, or of steep or ovoid or bulbous outline, like many Persian and Indian domes, and be crowned with a lantern or be without one. The supporting substructure may be a closed circular building or it may be an open structure of four or more arches bearing pendentives (q.v.). The term is often interchangeable with *cupola* (q.v.). By some writers the distinction between *cupola* and *dome* is made by referring the first only to the inner surface or shell of a domical roof or vault, and confining the use of *dome* to the outer roof or shell. A clearer distinction is that which applies the name "cupola" to domes which rest directly on the building without the interposition of a drum, using "dome" in the more general sense of the definition given above, which includes cupolas.

The history of the dome falls into two great divisions—the period before and after the invention of the dome on pendentives; or, roughly speaking, the period before and after the building of Hagia Sophia in Constantinople. It was known to the Assyrians and Persians, who used it over houses and palaces, sometimes with low, semicircular outline, sometimes with high ovoidal or pointed outline. These domes were made usually of brick and rested on solid walls. The Pelasgic and Mycenaean tribes also used the dome, but they built it of stone, starting its curvature from the ground, and constructing it not like a true vault, in which the courses have beds normal to the curve of the dome, but with horizontal beds, the courses successively projecting inwards each over the one below till they met at the top. Such was the Tholos of

Atræus at Mycenæ. The early Italian tribes, as well as those of Greece, used this kind of dome, which appears in Etruria and Latium (e.g., Vetulonia), where there even appear signs of the Oriental form. The Romans, however, appear to have been the first to give really monumental expression to the dome. With them it was a hemispherical vault of brick or of brick and concrete, resting solidly upon its circular base, as in the Pantheon, built by Hadrian, which remains the largest masonry dome in the world, 142 feet in diameter. A remarkable feature of this dome is the oculus, or opening, at its summit, the only window of the building; the effect of this method of lighting is singularly impressive. Smaller domes are those of the temple of Minerva Medica, in Rome, some of the halls in the *thermæ*, and a number of tombs of presumably late date. This form was popular in the Christian period for mausoleums, as in Santa Costanza, Rome, in which for the first time a dome was carried not by a con-

four piers and arches were made to suffice. The vast scale of Hagia Sophia, whose dome is 107 feet in diameter and rises to a height of 180 feet was never afterward duplicated, other Byzantine domes being much smaller and usually arranged in groups. The lateral thrust of these domes was resisted by buttresses or by the vaults of galleries and aisles. In Hagia Sophia (see SAINT SOPHIA) another great innovation was introduced in the form of a crown of 40 windows penetrating the base of the dome, which was strengthened by buttresses between them. This method of lighting is also seen in St. Mark's at Venice, built 500 years later, and was copied by the Turkish conquerors after 1453 in their mosques. In the later Byzantine churches, with their smaller domes, as such windows would have been trivial and inadequate, the dome was raised on a cylindrical drum (q.v.) in which were windows of practicable size. The ribbed system of construction of the vaults of St. Sergius and of Hagia Sophia



SECTION OF THE PANTHEON.

Note the increased depth of the dome as seen from inside, so that its main thrust is downward.

tinuous wall, but by a series of isolated supports, in this instance by 12 arches borne on a double circle of columns (c.325 A.D.). The dome was also a common form of roof for baptisteries (e.g., Ravenna, Nocera, Pisa, Florence). In the sixth century, after tentative attempts at Ezra in Syria, at San Vitale, Ravenna, San Lorenzo, Milan, and St. Sergius and Bacchus in Constantinople, the problem of suspending the dome on pendentives instead of on solid walls was solved in the church of Hagia Sophia, Constantinople. This was an invention, therefore, of Byzantine architecture and ushered in the second and more important period of dome construction. *Pendentives* (q.v.) are convex triangular spaces comprised between the arches springing from piers at the angles of a square or octagon and the circular base of the dome. By their means the dome is carried upon four or eight widely spaced isolated supports, between and beyond which the plan of the building may be extended in any direction and made to take on any outline or form desired. In the four transitional examples named above, eight supports were employed; in Hagia Sophia, for the first time,

was generally abandoned, and the vaults built in circular courses or rings, which were simpler and easier to construct.

In the Middle Ages the dome was generally abandoned in the West, though in Italy it was still used over the crossing in many Lombard and Romanesque churches and wherever the Byzantine influence was strong. The largest of these crossing domes is that of Pisa, which is elliptical and probably of plaster. Baptisteries were generally vaulted in Italy, and the eleventh-century dome of the Florentine baptistery was the largest octagonal vault in existence until the dome of the cathedral was built after 1420. That at Nocera, reproducing the general plan of Santa Costanza, is about 42 feet in diameter, or about half the diameter of the Florentine example. The octagonal and decagonal vaults of English-Gothic chapter-houses are ribbed vaults, not domes. The Old Cathedral at Salamanca, Spain, has a *cimborio*, or crossing dome, raised on a high drum; it is a ribbed dome internally, though covered externally by a low polygonal spire. There are also in Aquitania and about Périgueux in France a number of twelfth-century churches

with domes on pendentives, evidently derived from Byzantine prototypes, through the intermediary of Venice and Cyprus (Souillac, Solignac, Saint-Front at Périgueux, Angoulême, etc.). Meanwhile the dome was being developed by the Moslems into a feature now inseparably associated with the Orient. The dome of the Rock (Mosque of Omar) at Jerusalem, the largest of Arab domes and perhaps the earliest, is of wood, probably recalling that of the Byzantine church it replaced. Other Arab domes are small; the feature was first introduced in the tenth century in mausoleums connected with mosques in Cairo and elsewhere, but after the fourteenth century it was used over the prayer halls themselves, as in Kaft Bey at Cairo (1465). The Arab domes are ovoid or pointed in outline, often ribbed or carved on the outside, and carried on complex decorative corbelings of stalactite work (q.v.) instead of pendentives. In Persia a new type was invented: the swelling or bulbous dome. These domes were of brick, on pendentives of ingeniously interlaced ribs and vaults; many are of great beauty. This type spread to India, where it was reproduced in stone and marble, often on an imposing scale; that of the tomb of Mahmūd at Bijapur is 124 feet in diameter over a rotunda of 137 feet. Other important Indo-Moslem domes are those of the Ettiṃ-ed-doullah and Humayūn mausoleums, which surpass in size, though they do not approach in exquisite beauty, the alabaster dome of the Taj Mahal at Agra (1660). The Turks, after the conquest of Constantinople in 1453, employed Greek architects to build their earlier mosques after the pattern of Hagia Sophia, modified; and the noble domes of the Imperial mosques, especially of the Ahmediyé and Suleimaniyé, are the fine though tardy fruitage of the grand early Byzantine conception of Hagia Sophia. They present the sharpest contrast to the fantastic bulbous lanterns and towers of the Russian churches of Moscow, Nijni Novgorod, etc., which show the late Byzantine drum elongated into a high narrow turret, and the dome replaced by a bulbous termination of singularly Oriental aspect.

The Renaissance architects of Italy developed the dome as the distinctive feature of their church architecture, making of it a superb external feature by raising it upon a high drum and crowning it with a lantern. The earliest example is also the largest; it is that of the Duomo at Florence, built from Brunelleschi's designs, partly under his direction, between 1420 and 1446, and after his death in that year completed from his models in 1464. This is an octagonal dome, wholly of masonry in two shells carried by eight colossal ribs meeting in a ring at the summit, and 16 intermediate lesser ribs. The dome is 139 feet in diameter and 380 feet high to the top of the lantern. Domes on pendentives cover the crossings of nearly all the Italian Renaissance churches, and after the fifteenth century a number of large churches were built having a square or polygonal central area covered by a dome, sometimes with four half-domed apses opening out of it (Umiltà at Pistoia, Incoronata at Lodi, Consolazione at Todi, etc.). In 1506 Bramante began the building of a mausoleum church for Julius II on the site of the ruined basilica of St. Peter at Rome, with a central dome 137 feet in diameter on four arches with pendentives. Out of

this design, under the hands of later architects, grew the colossal church of St. Peter (q.v.), to which definite form was given by Michelangelo, whose final design for the dome, unfinished at his death in 1565, was carried out with slight changes by Della Porta and Fontana. This, though not the largest in diameter, is incomparably the finest and noblest of all domes, superb especially in its external form and proportions. It is 405 feet in total height, built in two shells resting on a magnificent drum adorned with 16 coupled column buttresses. This dome fixed the type for Italy and western Europe. In Italy hundreds of domed churches were erected between 1560 and 1800; and the domes of the Baroque period are the finest features of these churches, even when these are otherwise of commonplace or inferior design. In France the Sorbonne (Paris, 1635) was the earliest church with an important exterior dome; the Val-de-Grace, completed somewhat later, is of unusually elegant proportions; but both were far surpassed by the dome of the Invalides, by J. H. Mansart, begun in 1675. In this there are three shells—an inner one of stone with a large oculus, or opening, through which, as a frame, one sees the painting on the inner surface of the second shell, also of stone. The outer shell and lantern are of wood covered with lead. The Panthéon (1755–81 by Soufflot) also has three shells, but all are of stone as well as the lantern, which is carried by the second shell. In this arrangement, as well as in the peristyle about the drum, Soufflot followed the model set by Sir Christopher Wren in the noble dome of St. Paul's in London (1675–1710). Here the intermediate shell is conical below, like the dome of the Pisan baptistery, and carries the stone lantern, while the outer shell is of wood. Among later European domes may be cited the fine Pantheon-like rotunda of the church of San Francesco da Paola at Naples (1812), the dome of San Carlo at Milan, 108 feet in diameter, that of the church at Mistra in Malta, and the cast-iron dome of the cathedral of St. Isaacs, St. Petersburg. In the United States the dome of the capitol at Washington (by Walter, 1856–73), though unfortunately of cast iron, is externally of unusual beauty and dignity of design; its inner shell covers a rotunda 90 feet in diameter. (See illustration under WASHINGTON.) As far back as 1795 the dome had been adopted by Bulfinch as an external feature of the State capitol at Boston, and it has ever since been a distinguishing element of American State capitols: those of Minnesota at St. Paul, and of Wisconsin at Madison, are important recent examples. The dome of the Columbia University Library (New York) is 80 feet in diameter, of two shells—the inner one of steel and plaster, the outer one of masonry. The use of steel and concrete has made possible domes of great size at low cost, and the Guastavino system of vaulting has produced domes of great lightness as well as beauty in both religious and secular buildings. But the vast rotunda roof of the Vienna Exhibition of 1873, still standing, is not a dome, but a conical trussed roof of iron and glass over a rotunda 360 feet in diameter. The largest concrete dome thus far constructed (1914) is that of the new Public Library at Melbourne, Australia; it is 124 feet in interior diameter.

Consult: Choisy, *L'Art de bâtir chez les Romains* (Paris, 1873); id., *L'Art de bâtir chez*

*les Byzantins* (ib., 1883); Franz-Pascha, "Die Baukunst des Islam," in Durm, *Handbuch der Architektur* (Darmstadt, 1887); Isabelle, *Les édifices circulaires et les dômes* (Paris, 1855); Gasset, *Les coupôles d'Orient et d'Occident* (ib., 1889); Glenn Brown, *History of the United States Capitol* (Washington, 1900); Walther Altmann, *Die italischen Rundbauten* (Berlin, 1906); also the various monographs on St. Peter's, St. Paul's, etc. See CUPOLA.

**DOMENICHINO**, dô-mă'né-kě'nô, properly DOMENICO ZAMPIERI (1581-1641). An Italian painter of the eclectic school (q.v.). He was born in Bologna, Oct. 21, 1581, and studied for a time under Denys Calvaert, but chiefly under the Carracci. Among his schoolmates were Guido Reni and Francesco Albani; with the latter he formed a lifelong friendship. Together they visited Parma, Modena, and Reggio, studying the works of Correggio and his school, and it was in response to Albani's urgent letters that Domenichino went to Rome in 1603.

In Rome he was well received by his countrymen, especially by his teacher, Annibale Carracci, whom he assisted in his frescoes in the Palazzo Farnese. On Annibale's recommendation, he and Guido were employed in decorating the chapel of Sant' Andrea in the church of San Gregorio. In executing this commission a rivalry arose between the two painters. Both represented the "Martyrdom of St. Andrew," but while Guido chose the moment where the saint, at sight of the cross, falls into an ecstasy, Domenichino painted the martyrdom itself, in all its gruesome details. In 1614 he painted, for the church of San Girolamo della Carità, his "Last Communion of St. Jerome," now occupying a place of honor in the Vatican collection opposite Raphael's "Transfiguration." It is a noble and well-balanced composition, full of action, and is unquestionably the best of his works. In connection with his stay in Rome Domenichino decorated the villa of Cardinal Aldobrandini, in Frascati, with frescoes representing mythological scenes in heroic landscape, and the abbey of Grotta Ferrata with a fine series representing the life of St. Nilus (1609), among which the "Meeting of the Saint with the Emperor Otho" is particularly good. He also decorated the church of San Luigi dei Francesi in Rome with frescoes from the life of St. Cecilia.

In 1617, wearied by the annoyances caused by the jealousy of the painters in Rome, he returned to Bologna, and in 1619 he was married. From this time the Raphaellesque type of women disappears from his pictures and is replaced by one less impressive, indeed, but full of charm and more realistic—the image of his wife. His chief work of this period is the "Madonna of the Rosary," now in the Gallery of Bologna. In 1621 he returned to Rome and was named principal architect of the Papal Palace.

The chief works of his second stay in Rome were the "Four Evangelists," on the pendentives of the cupola of Sant' Andrea della Valle—noble and impressive representations—and a charming mythological canvas, "Diana and her Nymphs Hunting," in the Palazzo Borghese, Rome. In 1631 he went to Naples to decorate the Capella del Tesoro, in the cathedral, with frescoes representing the life of St. Januarius; but he was so restricted by his instructions and annoyed by the murderous threats of Neapolitan artists that he was unable to produce his

best work. He died suddenly at Naples, April 6, 1641, supposedly by poison. He was a man of modest disposition, diligent and conscientious in his work, and capable of fine and high emotions.

Domenichino and Guido Reni were the most important of the pupils of the Carracci, and Domenichino, though somewhat lacking in originality, was the most naturalistic of them all. His art is midway between that of the Carracci and Caravaggio. His works are uneven in color, and the dominating tone is a soft gray. He was fond of using landscapes as backgrounds which were of high decorative value, and also painted independent landscapes (Capitoline Gallery, Rome, and Pitti Palace, Florence). His portraits belong to the best done by the Bolognese school, good examples being the portrait of Vincenzo Scamozzi in the Berlin Museum, and that of Cardinal Agucchi, in the Uffizi Gallery, in Florence. As an architect he did some creditable work, but as a sculptor he was less successful. Consult the authorities referred to under BOLOGNESE SCHOOL OF PAINTING, and the monographs on Domenichino by Roncagli (Bologna, 1842); Breton (Saint-Germain, 1867); Serra (Rome, 1909).

#### DOMESDAY BOOK, or DOOMSDAY BOOK.

A statistical account of the state of England in the latter part of the eleventh century, prepared by command of William the Conqueror in the year or years just preceding 1086. It is one of the oldest and most valuable of English historical records. The origin and significance of the name is a matter of dispute. The Anglo-Saxon *Domas* were laws or dooms, and the term *Dom boc* occurs in the laws of King Æthelstan and in the ecclesiastical laws of King Edgar. In a specific sense the Anglo-Saxon Gospels use the word *domesdæg* for "judgment day." The inference, therefore, is that, as applied to the famous record which became the basis for the adjustment of all future land relations, the term contains the two ideas of supreme authority and of final judgment or doom. The book has been known by several other names. It is mentioned as the *Rotulus Wintonia*, or the 'Winchester Roll'; *Scriptura Thesauri Regis*, or 'The Writings of the King's Treasury'; *Liber de Wintonia*, or the 'Book of Winchester'; and *Liber Regis*, or 'The King's Book.' The book itself bears in its colophon or seal the simple title *Descriptio*.

An anonymous contemporary has told the story of the *Domesday Book* in simple and vigorous language, and a translation of this plain and faithful narrative will best describe the way in which the work was first set on foot: "In the year 1085, . . . at midwinter, the King [William the Conqueror] was at Gloucester with his Great Council, and there held his court five days; and afterward the archbishop and clergy had a synod of three days. There were Maurice chosen Bishop for London, and William for Norfolk, and Robert for Cheshire. They were all the King's clerks. After this the King had a great consultation and very deep speech with his council about this land—how it was peopled, or by what men. He then sent his men all over England, into every shire, and caused them to ascertain how many hundred hides of land it contained, and what lands the King had in it, what castles there were in the several counties, and how much revenue he ought

to get yearly from each. He also caused them to write down how much land belonged to his archbishops, his bishops, his abbots, and his earls, and—that I may be brief—what property every inhabitant of England possessed in land or in cattle, and how much money this was worth. So very straitly did he cause the survey to be made that there was not a single hide nor a yardland of ground, nor—it is shameful to say what he thought no shame to do—was there an ox or a cow or a pig passed by that was not set down in the accounts, and then all these writings were brought to him.” The survey was made by the King’s commissioners, but they seem to have had the aid of the chief men of every shire. A sworn jury, composed of the sheriff, lords of manors, priests, heads of hundreds, bailiffs, and six village tenants, made the inquest. There has been preserved for us the “Inquest of the County of Cambridge,” an early return of the survey of that county. The *Domesday Book* for Cambridgeshire was afterward compiled by the royal secretaries. In making this transcription many errors and omissions were made. The same fact is noted when the *Domesday Book* is compared with the Exeter *Domesday*, an early return for the five southwestern counties of England. The enumeration of the cattle and swine, which the chronicler thought so shameful, is recorded in the original return for these counties, but is omitted from the *Domesday Book*. The omission was doubtless intentional, because such data could have no permanent importance. The errors and omissions, however, indicate beyond doubt that the persons who collected the original information were not the compilers and writers of the *Domesday Book*.

The local jury made the inquest as to the name of the place, who held it in King Edward’s time (1042–66), and who was the actual possessor. They ascertained the number of hides in the manor, and what portion was reserved in the lord’s own hand. The villeins, cotters, and serfs, freemen, and socmen were enumerated. A census was made of the wood, meadow, and pasture, together with the number of mills and fishponds. Of all this there was to be a threefold return or valuation—as the land was held in King Edward’s days, as it had been given by King William, and as it stood at the time the survey was made—and the jurors were to say further whether the assessment could now be raised. On the basis of the divisions of the country given in *Domesday* the taxes were levied.

The value of *Domesday* as an historical document can best be understood from an enumeration of the subjects which it elucidates. Besides giving the names of all those who held land under King Edward, and of the fortunate Normans who supplanted them after the Conquest, the book treats of the ancient customs of the realm in great detail. It describes the duties of the cities and towns when the King visited them, sets forth all the titular distinctions of the period, ecclesiastic, official, and lay, and mentions the different trades and occupations of the time. There is a classified census of the people, together with an account of the condition of the country, town, and city population. The measures of land are amply recorded, as are also the territorial names, jurisdictions, franchises, tenures, and services. Lists of foreign tenants and lands held by foreign monasteries have been compiled from the names

enumerated in the book. Castles, manors, and markets find mention, as well as the condition of the churches, with their endowments and tithes. The book contains information about the metals in use at the time, and also about the quarries of stone and the springs from which salt was obtained. Eight varieties of money are spoken of, and innumerable facts are given about their use. We get occasional hints as to the legal procedure of the time, both civil and criminal. The mere statement which has been made of its contents is enough to show the immense value of the *Domesday Book* for all purposes of inquiry into the condition of England under the early Norman kings. “It will ever,” says Dr. Stubbs (*History of England under the Normans and Angevins*, London, 1845), “be found an inexhaustible source of information respecting the Anglo-Saxon and Norman constitutions, particularly in regard to the rights and revenues of the kings and their vassals, the relations of cities and towns, statistical accounts of various kinds, families and landowners, together with innumerable matters highly interesting to inquiring posterity, though unnoticed by the chroniclers of those times, either as too well known or as worthless. An intimate acquaintance with *Domesday* should supply the basis of every historical account of England particularly of its special history during the Middle Ages.”

The *Domesday Book* first appeared in print in 1783, in two folios. Types were cast for the purpose, so as to represent the abbreviations and contractions of the original manuscript. The work was 10 years in passing through the press. In 1816 two supplementary volumes were published. One contained an excellent general introduction by Sir Henry Ellis of the British Museum, with indexes of the names of places and of tenants in chief mentioned in the work. The other volume contained four other records of the same nature: (1) the *Exeter Domesday*, already mentioned; (2) the *Inquisitio Eliensis*, a record closely resembling the Exeter *Domesday*, containing the survey of the lands of the monastery of Ely, in the counties of Cambridgeshire, Hertford, Essex, Norfolk, Suffolk, and Huntingdon; (3) the *Winton Domesday*, containing two surveys of the city of Winchester—one made between 1107 and 1128, and the other in 1148; and (4) the *Boldon Book*, a survey of the possessions of the see of Durham, made in 1183. This work is especially valuable in that it partially makes up a deficiency in the survey for *Domesday Book*, which did not extend to the counties of Durham, Northumberland, Westmoreland, and Cumberland, either, it would seem, because they had lately been laid waste by the Conqueror, or because his authority was not fully established in them. A new and better edition of the *Boldon Book* was issued in 1852 by the Surtees Society, which in 1857 printed *Bishop Hatfield’s Survey*, another record of the possessions of the see of Durham, compiled between 1345 and 1381. In 1861 a facsimile copy of that part of *Domesday Book* which related to Cornwall was published by the Ordnance Survey as an example of what could be done by the process of engraving called photozincography. This experiment proving successful, the government continued publishing the rest of the *Domesday Book*, county by county, in the same way.

In 1872 the government ordered a general re-



turn of owners of land to be prepared by the Local Government Board. This new *Domesday Book* was published in 1874-76.

**Bibliography.** The literature of the subject is extensive. The various volumes in *The Victoria County History* give a translation of the text for each county, with commentary and map. The more valuable secondary books are: Maitland, *Domesday and Beyond* (London, 1897); Freeman, *History of the Norman Conquest*, vols. iv, v (Oxford, 1869-76); Ellis, *General Introduction to Domesday Book* (2 vols., London, 1833); Léchaudé D'Anisy, *Recherches sur le Domesday* (Caen, 1842); *Domesday Studies*, ed. by Dove (2 vols., London and New York, 1888, 1891); Round, *Feudal England* (London, 1895); Birch, *Domesday Book: A Popular Account* (ib., 1887, containing a good bibliography of the subject); Ballard, *The Domesday Boroughs* (Oxford, 1904); *The Domesday Inquest* (London, 1906).

**DOMESTIC** (Lat. *domesticus*, from *domus*, house) **ANIMALS.** Those species of animals which have been brought under control by man and adapted to his uses or pleasure.

**Significance and Effects of Domestication.** Domestication implies taming and accustoming to the presence of man, to a greater or less extent, and a change from the wild habit; but the mere taming of an individual does not constitute domestication. Cultivation through a series of generations is necessary to fix domestic traits; and this is usually accompanied by a system of selection and breeding to develop and render permanent the qualities which are especially desirable. Domestication also implies a certain amount of care of the species, protection from severe weather, from wild animals, and from one another, and the providing of food or of the conditions under which it may be obtained. Domestic animals are also trained to some extent and are confined or kept within bounds, and, in general, their activities and lives are under control, as distinguished from the freedom and the self-dependence of the wild state.

The changes in food, environment, habits, function, and breeding bring about many modifications in the outward form, external appearance, temper, and general character of animals, which soon distinguish them from their progenitors. The hair or wool becomes of a softer texture, the color of the coat or feathers changes, and the general conformation of the animal is greatly altered. The changed habits of life, as well as the food, and the daily work or exercise, tend to the development of some parts of the body more than others, the emphasis of some characteristics and the suppression or elimination of others. Thus, the skull of hogs which have not been required to root for their food has become shorter and the snout much blunted, and the intestines of the improved breeds of hogs are much longer in proportion to the size of the animal than those of the wild or earlier domesticated forms. This undoubtedly means that the modern pig, which is highly fed to hasten its growth, can eat a larger quantity of food in a given time, and it may indicate that he can digest it more thoroughly than his ancestors.

It may be said, in general, that under domestication animals mature earlier, become more fertile, often more prolific, and present a greater tendency to variation than in the wild state. There are exceptions in which these changes are

not all apparent, and it should be noted that species differ greatly in the extent to which they respond to, and are altered by, domestication. Sometimes the changes induced in appearance and characteristics have been comparatively slight, as in the case of the camel, the elephant, and the ostrich; while in other cases they have amounted to the evolution of forms which in a wild state would be regarded as new species.

As a rule, the species which under domestication have proved most useful to man have possessed high fertility, giving numbers, and marked tendency to variation, giving opportunity for improvement and development in some particular direction by selection and breeding. These are prime requisites to rendering a species of great adaptability and usefulness; and the absence of them in some has restricted the scope of their usefulness. The camel, e.g., appears in its native state to have possessed qualities which suited it admirably to man's uses in a rather limited region; and, not exhibiting a marked tendency to vary, it has not been changed much by man, nor have any traits been artificially developed to a high degree. His range of usefulness will probably remain in its present bounds and become more and more restricted as civilization advances in the regions where he now finds his greatest usefulness. Cattle, on the other hand, tend strongly towards variation, and breeds showing wide differences in size, tendency to beef production, milk production, and the richness of the milk, have been developed. As between the cat and the dog, the former possesses great fertility and fecundity, but apparently only slight tendency to variation, and hence in all the years that the cat has been domesticated man has not developed from it an animal of much special use beyond that as a pet; while the dog varies so greatly that a number of races have been developed by selection and crossing which differ greatly in character, and many of them have been turned to use in a variety of ways.

Animals differ greatly in their adaptability to domestication. The wild traits seem more firmly stamped on some species than on others. To admit of successful and profitable domestication, they should be of social and docile disposition, and capable of retaining their fertility under changed conditions. Some species will not breed in confinement or become unproductive. This is often due to inability to observe the natural or customary habits at breeding time and is observed in some birds. On the other hand, hybrids are more readily produced under domestication. See **BREEDING**.

**Classes of Domestic Animals.** The domestic animals practically all belong to the classes of mammals or birds. The larger number and the more important of the former class are herbivorous and are kept for their flesh, milk, wool or hair, hide, etc., or as beasts of burden, some species, as cattle, being kept for all of these purposes. The most common of the herbivora are cattle, sheep, goats, the buffalo, yak, reindeer, camel, llama, alpaca (ruminants), and the horse, ass, hog, and elephant (pachyderms). The zebra has been tamed and domesticated to some extent; but, like the elephant, no domesticated race of the species exists. Although the elephant has been much employed for many ages for various purposes in India, the individuals are still taken, to large extent, from the wild denizens of the forest, and this animal can only



be said to be half domesticated. The mule, a very important and valuable work animal, is not a distinct species, but a hybrid, the product of the male ass and the mare, resembling the ass much more than the horse; and the hinny, or muto, is the product of the stallion and the she-ass, possessing many of the characteristics of the horse. Both of these animals are incapable of reproduction.

Of carnivorous quadrupeds, there are only two which have been generally and individually domesticated—the dog and the cat. These are kept largely as pets and for ornament, although, as noted above, the dog has been bred and trained to many uses, such as herding cattle and sheep, protection of life and property, hunting, and as a beast of burden. Certain species of foxes are kept under domestication in Alaska and bred for their fur; they become tame, but cannot be reckoned among domestic animals in a restricted sense. A long list of other quadrupeds are tamed and kept as pets and partially or individually domesticated. This is true of the rabbit, guinea pig, ferret, and mungoes, e.g., which are also useful under some conditions. The Belgian hare has recently been kept and bred quite extensively in a number of countries for its flesh.

Of birds, the most important of the domesticated species are gallinaceous—the common barnyard fowls, of which there are many widely different varieties, the guinea hen, and the turkey; to which should be added ducks, geese, and swans, which belong to the web-footed water birds. Pheasants, peacocks, and pigeons are thoroughly domesticated, being kept principally for ornament, although the breeding of them is something of an industry. The ostrich has for some time been kept in confinement in Africa, and more recently in California and Arizona, where quite large ostrich farms are operated on a commercial scale. The birds pair, lay eggs, and rear young plentifully under these conditions and may be said to be partially domesticated. Song birds, parrots, and similar birds which are kept as pets, cannot be said to be truly domesticated species, nor can the various hawks and falcons which are used to hunt living prey. The tame fishing cormorants of China hardly come under the heading of domestication, nor can a long list of birds which have largely abandoned their wild habits for an association with man, such as the swallows, swifts, and other species. The same applies to rats, mice, snakes, vermin, etc., which have associated themselves with man for protection and their own advantage. These are not generally classed among the domestic animals, although kept by man under quite natural conditions for his pleasure and use; nor are snails, oysters, turtles, etc., to which his care has been extended. These, together with a number of species of useful insects, such as the bee, silkworm, and cochineal insect, are more properly described as *cultivated* than as *domesticated*.

For further details regarding the description and origin of various kinds of domestic animals, see CATTLE; HORSE; SHEEP; FOWL; GOOSE.

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**DOMESTIC ECONOMY.** See HOME ECONOMICS.

**DOMESTIC RELATIONS.** The legal relations subsisting between the members of a family or household, the law of domestic relations being made up of the rules which define and regulate the rights and duties of these members with respect to one another. The separate grouping of these rules is a matter of convenience rather than the result of an attempt at logical classification. Indeed, every treatise on this topic contains a large amount of material that is taken bodily from the law of agency, of contract, and of tort. In other words, the law of the domestic relations is not in all its parts a distinct and independent branch of the law, but is made up in large part of legal rules from other branches of the law. As thus conceived, it forms a part of the law of persons, in which the ordinary legal relations are varied by the abnormal status of persons under the various degrees of disability or of legal privilege to which the members of a family are subject. But it also includes the rights arising out of the status of the various family relations, as marriage and divorce, the rights of children against their parents, and the like. The topics ordinarily discussed under this general heading are those of husband and wife, parent and child, guardian and ward, master and servant. It is admitted that the last of these topics, covering as it does the contract relations of employer and employee, carries the discussion far beyond the limits of the modern family or household. For this reason some recent writers on domestic relations have dropped this topic entirely, or limited their consideration of it to the rights and duties of domestic servants. The attempt has been made in some States to codify the rules applicable to this subject. This has been done in New York by a statute known as the Domestic Relations Law. Its scope is fairly indicated by the headings of its various divisions, viz.: Unlawful Marriages; Solemnization, Proof, and Effect of Marriage; Rights and Liabilities of Husband and Wife; The Custody and Wages of Children; Guardians; The Adoption of Children; Apprentices and Servants. See Gilbert, *Domestic Relations* (Albany, 1902); Rodgers, *Domestic Relations* (Chicago, 1899); Schouler, *Domestic Relations* (Boston, 1905); Long, *Domestic Relations* (St. Paul, 1905); Laws of New York, chap. 272 of 1896. See also the articles GUARDIAN; HUSBAND AND WIFE; MASTER AND SERVANT; PARENT AND CHILD, and the authorities mentioned under each of these titles.

**DOMESTIC SCIENCE.** See HOME ECONOMICS.

**DOMESTIC SERVICE.** By domestic service is meant the work done in and about the house to provide for the physical comfort of its occupants. It includes the labor of housekeepers, cooks, laundresses, chambermaids, waitresses, nurses, butlers, coachmen, footmen, garden-

ers, choremen and charwomen, and personal attendants.

The condition of household service in different countries varies according to the remoteness of the countries from the feudal state of society and industry. Where the social organization remains aristocratic, there is a class bred more or less definitely to service, at least as to mental attitude. Where democratic conditions prevail, there is no such class. Yet the relation between employer and employed in domestic labor, even in democratic countries, has not resolved itself as it has in other industries. The personal element remains, as between the feudal baron and his retainers. The work is done with all the waste of energy and material attendant upon individual effort as opposed to coöperation. The industry is altogether in an involved transition state.

In ancient times the work of the household was done by slaves. In modern times it has been very largely done by the women of the household and by women employed by them as helpers. To the former fact is largely due the stigma of social inferiority attaching to domestic service and to the latter its uncertain standing as an industry.

The social status of the household servant is everywhere about the same; but as the democratic form of government is approached, the social inferiority which service involves becomes more and more dreaded and despised, and the marks of it more abhorrent to the servant. For instance, it is often difficult to persuade a maid or a nurse in the United States to wear a cap, and English women servants are beginning to protest against that badge; while German and French ones seem, on the contrary, rather proud of their uniforms.

Except where there is a contract specifying other terms, domestic servants in England are hired by the year. Their wages are payable quarterly. Their master is bound to find them suitable lodging and board. The contract, once entered upon, can be terminated only by a month's notice on the part of the servant or the payment of a month's wages on the part of the employer. Immediate dismissal may follow the discovery of immorality, theft, disobedience, extreme inefficiency, or permanent disability. The employer may not legally keep back money from the servant's wages for any breakage, damage, or loss on the part of the servant.

In Germany a two weeks' notice is sufficient to end the service. The employer there is obliged, at the termination of a servant's employment in his house, to register with the police authorities a letter defining the record of the employee while in his service. This is filed in the police book; and as premiums are paid by masters and mistresses for the servants having the best police-book records, it becomes a matter of moment to the servants to maintain good ones. The objection to this system is that the records are not always entirely accurate, although great care is exercised in the matter by the authorities and strict rules are made to govern it. Most of the German servants are drawn from the peasant class, coming from the country to the provincial towns and thence to the large cities.

In France and Italy conditions do not greatly differ from those of Germany, except that the police-book system is not used. In France more men are employed for household work, and there

is less waste than in any other country. Italy and Spain approach more nearly to the feudal system of domestic service.

In Russia, in the country regions, the feudal system prevails. For a piece of land—about two acres—out of the estate, one cow, and the privilege of raising as many pigs and chickens as the serving family desires, a landed proprietor may obtain whole villages of retainers, the services of all of whom are his at his need. In St. Petersburg most of the household servants are Finns. Here also enough of the feudal system remains to make it no uncommon thing for a servant to remain 20 years in one family's employ.

In the United States the earliest white servants were the transported convicts and the redemptioners. The redemptioner's services were sold for a term of years to a colonist, either by himself, by one of his creditors, or by the captain of the vessel in which he took passage. In addition to the servants from these two classes there were slaves, both Indian and negro.

This state of domestic service lasted through the Colonial period to the time of the Revolution, when indented service was replaced in the North by free labor and in the South was entirely superseded by negro slavery.

From the Revolution until the middle of the nineteenth century the servants in the North, except in the great cities, were the social equals of their employers, as is still the case in many parts of the West and Middle West. It was in deference to this equality that the use of the word "servant" was abandoned and that of "help" substituted. All suggestion of servitude was abolished. Liveries, even caps, were not worn. The "help" sat at table with their employers, called the members of the family by their Christian names, and were, in fact, what their name implied—friendly assistants, salaried but independent. This condition of domestic service in the North lasted almost as long as the patriarchal state of slavery in the South.

About the middle of the nineteenth century a change in the state of affairs throughout the United States began with the flood of immigration. The famine of 1846 in Ireland, the German revolution of 1848, and the conditions preceding and following it, and the Treaty of the United States with China in 1844, loosed upon this country an unprecedented number of foreigners. Of the Irish and German immigrants, nearly one-half were women. They entered as "unskilled laborers." The household industries have always been sought by unskilled labor. In the East these immigrants entered at once into the serving class. In the West, along the Pacific coast, the Chinese became the competitors of the natives in household labor, working more cheaply and more skillfully and rapidly displacing such Americans as were engaged in domestic service. These conditions have been somewhat modified by the restrictions on Chinese immigration.

The question of domestic service in the South has been a vexed one since the Civil War. The negroes, long held in servitude and unaccustomed to think for themselves, were suddenly loosed upon the community and given the same rights and privileges as the whites without knowledge of how to use them. The habit of submission did much to restrain them, and their inherent tendencies have prevented them from organizing to any great extent. Many of

them have come North to compete with the immigrants: but this has had no marked effect upon the conditions of domestic service, nor until recently have many white servants been employed in the South. Those who remained in the South have many of the faults of the slaves, with an independence which makes them insusceptible to control; but time, patience, and education are bettering these conditions.

The foreigners in the East found the field ready for them. The women in New England who had in the early days acted as "help" in their neighbors' homes were entering the recently established factories in large numbers. In the early times each household had raised not only its own food products, but its own clothing stuffs as well. The home had been cotton and woolen mill, dressmaking and tailoring shop. The development of machinery took this class of work out of the house, and many of those who had been accustomed to do it in the house followed it to the mills. It was a more remunerative and more independent occupation than household labor, even under the free and equal régime. The Northern women are glad to give over the household labor to the immigrants, but set themselves the difficult task of adapting European methods to American conditions. With increased wealth came the desire for display, and the patterning of household after foreign usage. The result word "servant" came again into use, and domestic service sank in the social scale, while at the same time the immigrants themselves were eagerly imbibing the democratic ideas of their adopted country.

The foreigners have remained practically in control of the American kitchen ever since they took possession of it. According to the reports of the Immigration Commission, the negroes represented nearly 27 per cent of all female servants in 1900; the foreign born, 26 per cent; the native white of foreign parentage, nearly 20 per cent. In cities of population over 50,000 the foreign-born whites provided 44 per cent of the female servants; the negroes, 22.8 per cent; the native born of foreign parentage, 20.3 per cent. In the lesser cities and the country, negro servants represented 29.4 per cent; foreign born, 16 per cent, and native white of foreign parentage, 19.5 per cent. The Irish and Germans contribute the largest quota to the foreign-born servants, 39.5 and 17.4 per cent respectively.

In the farming districts of the Northern and Western States the old conditions of equality above mentioned still prevail. The farmers' wives do their own work, with the help of a "hired girl," and the farmer employs for his field work and chores a "hired man." Both of these are practically members of his family and his social equals, as they are often sons and daughters of his neighbors. Household servants are found mainly in the large cities, partly on account of the congregation of wealth there, and partly on account of the servant's rooted objection to the country—an objection which is doubtless partly due to the foreigner's desire not to be completely isolated from all her kind as well as from her home.

In England and on the Continent wages are much smaller for household labor than in the United States. Four dollars a week, which is lower than the Western and only a little higher than the Eastern average, is a phenomenally

high rate there. In addition, in some parts of the Continent, servants are not necessarily boarded from their employers' tables, and the English may or may not be, as the agreement specifies. "Board wages" are paid instead, and they are very small, sometimes not more than 20 cents a day. Even when food is provided by the employer, it is not likely to be of the same variety as that which serves his own table. "Beer money" and "tea money" are generally stipulated for in English contracts. But the European servants, even in small establishments, have a means of revenue which only the servants of the wealthy or of corporations have here. Tips from guests are a recognized source of income; and the German maid, e.g., lighting a caller to the front door of a modest apartment house in Berlin, would feel defrauded unless she received her small fee.

The advantages enjoyed by household servants in this country are many. They are generally lodged more comfortably than they would probably be otherwise. Numerous as are the complaints against "the girl's room" of a small establishment, it is usually moderately comfortable. The food is generally good. The wages, considering that lodging, light, heat, board, car fare, and expensive dress are not to be provided from them, are much better than shop and factory wages and do not compare badly with the salaries of teachers. On the other hand, household servants have practically no chance to rise in their occupation; they are isolated, both industrially and socially. They have almost no personal freedom, and their standing is regarded as lower than that of other women workers.

Mistresses complain of the uncertainty of the whole situation; there is no fixed rate of wages, no fixed term of service, and no fixed standard of excellence.

Various remedies have been suggested to meet these difficulties, none of which have proved entirely adequate. Some advocate a return to the more patriarchal system of the past and believe in making the relations between mistress or master and servant a more personal one. Some have advocated a "shift system" for servants—setting each to work for only eight hours, and then relieving him or her by another. This plan has been successfully adopted in Chicago by a very rich woman. It would, in its present form, be possible only to the very wealthy, or to an organization of some sort.

Others advocate the abolition of all individual domestic labor. Various schemes for the children, with their bedrooms and dining rooms for the adults, seem to them to solve the problem. This, the cooperative housekeeping scheme, has been often tried and generally with a signal lack of success. The failures, however, seem to have been due rather to mismanagement or to too sweeping and hurried changes than to any inherent impossibility in the plan. Thus, though one of the first arrangements of this sort tried in America, at Cambridge, Mass., in 1871, was not a success, a similar effort on a modified plan, in Brookline, Mass., 25 years later, has not been a failure. This is the Beaconsfield Terrace Scheme—a business affair, rather than a sociological experiment, in intention. The residents of the terrace have, in addition to their own yards, an inclosed park in common. They share tennis courts; a casino, where any one of them may entertain on a

larger scale than in his own home; the services of a choreman; the time of a superintendent of the buildings; and so on. Their heat is supplied from a central main room and not from individual furnaces. The difficulty, with coöperative housekeeping is that most persons instinctively object to it on the ground of lack of privacy. They feel that they will be deprived of their homes and given instead an improved boarding-house system, and that under these conditions their children cannot develop properly. Many, too, see in such plans danger of being victimized by "cranks" and people of uncertain social views.

Some of those who look forward to the amelioration of domestic service believe that it will be brought about by the establishment of training schools for household servants. So far, however, industrial training schools have received little patronage from the class for whom they are intended. The servants themselves fail to perceive the importance of training, since they can obtain good wages without it, and their ambition is not stimulated by the possibility of rising in the social scale through such training.

In England some schools designed and endowed to prepare girls for household service have become sewing and dressmaking schools, under the dislike of the girls and their parents for household labor. In Belgium schools of industrial training have been instituted by the government and are run under government inspection and control. They have succeeded much better than the private enterprises of other countries, although they are for general household training and not specifically for that of servants.

Profit sharing has also been tried in the household and has on the whole proved successful. The plan is to set aside a certain amount for housekeeping and divide what can be saved out of it between the mistress and the servants in accordance to a proposition previously agreed upon. This, of course, gives the servants an interest in the welfare of the household and has the same advantages and disadvantages as a similar system in business.

Another solution for the domestic-service problem lies in the modern tendency towards specialization. Many kinds of work formerly done in the house, under the supervision of its mistress, are now provided for outside of it. Trained workers take up some special branch of household labor and contract for it with a number of families. It does not appear as yet that specialization will solve the problem altogether.

The servants' unions which have been organized have not yet accomplished anything serious. Nevertheless, it is the opinion of almost all students upon this subject that along this line—the organization of the industry upon a practical business basis, with a regular scale of wages for various grades of skilled and unskilled work, with fixed hours for work and the stigma of servitude removed—lies the hope of betterment. Such a system would necessitate proper training on the part of those who wished to share in the benefits of the organization and many concessions on the part of employers.

**Bibliography.** Salmon, "Domestic Service," which contains a bibliography, in *Eleventh United States Census Report* (Washington, 1892-94); Baylis, *The Rights, Duties, and Relations of Domestic Servants* (5th ed., London,

1896); id., *Domestic Servants and the Law* (ib., 1906); Graham, *Master and Servant* (ib., 1899); Adams, "A Belated Industry," in *American Journal of Sociology*, vol. i (Chicago, 1896); Walker, *The Wages Question* (New York, 1886); Schloss, *Report on Profit-Sharing* (London, 1894); Herrick, *Expert Maid Servant* (1904); *Reports of the Immigration Commission*, especially vol. 28 (Washington, 1901-12); Casswell, *Law of Domestic Servants* (London, 1913).

**DOMETT, ALFRED** (1811-87). An English poet and colonial statesman, born at Camberwell Grove, London. He studied at St. John's College, Cambridge, in 1829-33 and in 1837-39 contributed to *Blackwood's* several poems, of which the best known is "A Christmas Hymn." In 1841 he was called to the bar and in 1842 went to New Zealand as one of the earliest settlers in that colony. There he held many public offices, including those of Civil Secretary (1851), Commissioner of Crown Lands and Resident at Hawke's Bay (1853-56), and Prime Minister (1862-63). In 1871 he returned to England, and was created C.M.G. in 1880. He is the subject for Browning's poem "Waring." Browning's "The Guardian Angel" also addresses him. His publications include *Ranolf and Amohia: A South Sea Day Dream* (1872) and *Flotsam and Jetsam* (1877). Consult Gisborne, *New Zealand Rulers and Statesmen* (London, 1897).

**DOMETT, SIR WILLIAM** (1754-1828). An English admiral. He entered the navy in 1769, was made lieutenant in 1777, and during the American Revolution took part in various engagements with the French and Americans. He was appointed captain of the Baltic fleet in 1801 and then of the fleet off Brest. He was made K.C.B. in 1815, G.C.B. in 1820, and admiral in 1819.

**DOMEYKITE**, dô-mă'kit. A copper arsenide occurring in massive forms, with a metallic lustre and white to gray in color. It occurs in Chilean mines, also at Zwickau in Saxony, and in the copper deposits of Michigan. Domeykite derives its name from the Chilean mineral Domeyko.

**DOMICILIA.** See **LORX**.

**DOMICILE** (Lat. *domicilium*, from *domus*, house). The legal residence of a person. Though used in common speech as synonymous with "home" or "place of abode," in the strict legal sense "domicile" denotes the place which the law will hold to be a man's residence; and this may or may not coincide with the place where he in fact usually or habitually resides. It is a doctrine of modern law that every person shall have a definite location in some jurisdiction, to which his legal rights and obligations may be referred, and by which his legal status, public and private, is determined. The name and the notion of domicile, as well as the necessity for it, are comparatively recent and arise from the modern conception of law as being of territorial rather than of personal obligation. Formerly the important question was that of nationality, it being conceived that every person was entitled to be judged and to have his rights and obligations determined by the law of his national allegiance rather than by that of his actual domicile. But the complete triumph of the principle that the authority of a state extends to every one within its borders, irrespective of his nationality or citizenship, and that it is in the main confined to

those limits, has given a new importance to the question of domicile.

As the private and local law by which a person is governed, as well as his political status, now depends almost entirely on his domicile, the question what facts of residence and intention shall determine the domicile has been extensively discussed by the courts and law writers. The importance of the subject in international law has called for its especial consideration by the authorities in that field of jurisprudence.

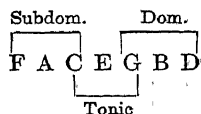
Vattel defines domicile as habitation fixed in any place with an intention of *always* staying there. This definition is now regarded as too limited by most authorities on international law, certainly by the best writers on the subject in the United States. It is held that in a newly settled country, like the United States, absolute permanence of residence is rare, and it is sufficient to constitute a domicile that the habitation be fixed without any present intention of removing therefrom. Justice Story says: "Two things must concur to constitute a domicile—first, a residence, and, second, the intention of making it the home of the party"; to which Dr. Woolsey adds: "And when once a domicile is acquired it is not shaken off by occasional absences for the sake of business or pleasure, or even by visits to a former domicile or to one's native country." It follows that the same person may be a citizen of one country, possess a domicile in another (for the questions of domicile and citizenship are quite distinct), and temporarily reside in still a third. Another American authority, Wharton, distinguishes three kinds of domicile: domicile by birth, by choice, and by operation of the law; and this classification is now generally accepted. The first is determined by the place of nativity, the second is acquired by a man's own volition, and an illustration of the third is the domicile of a wife, being that of her husband acquired by her at the time of marriage. A child, of course, has the domicile of his parents and is considered incapable of changing his domicile of his own accord, but he follows any change in the domicile of the parents. When the father of a family dies, the domicile of his children and widow continues to be that of his last residence until a new one is acquired in any of the ways already indicated. The question, what amounts to a sufficient intention of permanent residence to cause an immediate change of domicile, is one of no little difficulty, which must be determined by the special facts of each case.

In its relation to private rights and obligations the rule may be laid down in a general way that the law of the place of domicile governs in contracts relating to personal property and in the matter of wills and bankruptcy; while, on the contrary, in matters relating to real estate the law of the place of its situation (*lex rei situs*) prevails. In England it was formerly held that it was necessary to the validity of a will that it should be executed according to the law of the testator's domicile, no matter where the will was drawn; but statutes now provide that the will is valid if executed in accordance with the law of the country where it was made, even though it do not conform to the law of the place of permanent and recognized domicile. Similar provisions exist in most or all of the States in the Union. See CONFLICT OF LAWS.

The question of domicile is often of importance in determining property rights in time of war. Thus, it is held that the property of an alien domiciled in a country with which his own nation is at war is subject to seizure as that of an alien enemy. Under a strict construction of the common law, also, an alien cannot (regardless of the existence of war or peace) hold land, either by purchase or inheritance; but in many of the American States this rule has been directly abolished by statute as opposed to the natural policy of this country, and in others it has become obsolete by general consent. (See ALIEN.) Under the Roman or civil law it was considered that a man might legally hold two domiciles, as when he resided part of the year in one place and part in another, or when he maintained two businesses in separate places; but, as has been explained above, the modern law of Europe and America has no room for this conception. In matters of taxation and in the application of the poor laws the term "domicile" is often used, sometimes loosely, and its definition is often of importance in deciding such matters; the courts will often in treating such questions give the word the more restricted meaning that is attached to the words "dwelling-place," "home," and "residence." It has been held by several American courts that the domicile of a sailor is the place where he voluntarily spends most of his time when on shore. See ALLEGIANCE; CITIZEN; SUBJECT.

The most important authorities are Dicey, *The Law of Domicile* (London, 1879); id., *Conflict of Laws* (ib., 1896); Round, *English Law of Domicile* (ib., 1861); Westlake, *Private International Law* (4th ed., ib., 1905); Moore, *Digest of the International Law of the United States* (Washington, 1903); Stocquart, *Studies in Private International Law* (Brussels, 1900); Bentwich, *Law of Domicile in its Relation to Succession* (London, 1911); Jacobs, *Treatise on the Law of Domicile* (Boston, 1912).

**DOMINANT** (from Lat. *dominari*, to rule, from *dominus*, lord; connected with Gk. *δᾱμᾱν*, *daman*, Skt. *dam*, to subdue, OHG. *zam*, Ger. *zahn*, Icel. *tamr*, AS. *tom*, Eng. *tame*). In music—1. The fifth tone of the scale. 2. *Dominant chord*, the triad upon the fifth degree. So in the key of C it is g-b-d. It is always a major chord in both major and minor keys. 3. *Dominant seventh*, a chord obtained by adding a minor seventh to the dominant triad. Its resolution is determined by the third, which, being the leading tone (q.v.) of the scale, moves a half step upward; and the seventh, which always descends a half step. In the key of C the dominant seventh is g-b-d-f; the resolution, g-c-e. 4. The *key of the dominant* is the one most closely related to the tonic key. Next comes the key of the fifth below or subdominant. All the tones of the scale can be regarded as component elements of these three fundamental chords, thus:



**DOMINANT AND RECESSIVE.** See MENDEL'S LAW.

**DOMINE QUO VADIS**, dō'mē-nā kwō vā'dēs. A small church on the outskirts of Rome on

the Appian Way, named from the tradition that, when Peter was fleeing from persecution in Rome, he was met at this place by Christ going towards the city. Peter, astounded, asked, "Domine, quo vadis?" ('Lord, whither goest thou?'). The Saviour answered, "To Rome, to be crucified again"; and the Apostle in shame retraced his steps to the city. In the church is shown a stone bearing an alleged footprint of Christ.

**DOMINGO**, dô-mên'gô, SAN or SANTO. See SANTO DOMINGO.

**DOM'INIC**, SAINT (1170-1221). The founder of the Order of Preaching Friars (*Fratres Prædicatorum*) in the Roman Catholic church. He was born at Calaroga, in the north of Spain, probably of the illustrious Guzman family. He studied theology in Palencia and in 1195 became canon of Osma in Castile. With his superior, Diego d'Azevedo, Bishop of Osma from 1201, he made several journeys, one as far as Denmark. On their way back to Spain from a visit to Rome they found at Montpellier three papal legates debating on the means to be adopted for the suppression of the Albigensian heresy, and recommended as the most efficient means the setting of a notable example of humility and self-denial. Dominic, with his Bishop, began to preach throughout Languedoc, and in the following year founded at Prouille his first institution, an asylum for poor girls who were in danger of changing their faith through the inducements held out by the rich and powerful adherents of the new belief. There has been much discussion as to his part in the crusade of extermination against the Albigenses headed by Simon de Montfort after the murder of the papal legate, Peter of Castelnau. The truth seems to be that his activity was limited to prayer for the success of the Catholic arms, and urgent labor for the conversion of the people. From 1215 his life was spent in arduous work in connection with the order which he founded in that year. (See DOMINICANS.) After holding the second general chapter of the order at Bologna in 1221, he had made up his mind to preach the gospel among the heathen Cumans, a Ugrie tribe in Hungary, and, if possible, to gain the crown of martyrdom; but he died on August 6, at . . . his body is buried in the church . . . Pope Gregory IX canonized him in 1234. Consult: The original Life by Jordanus, *De Principiis Ordinis Prædicatorum*, ed. J. Berthier (Freiburg, 1892); Lacordaire, *Vie de Saint Dominique* (Brussels, 1841; Eng. trans., London, 1883); Drane, *The Life of St. Dominic* (3d ed., London, 1891); Herkless, *Francis and Dominic* (New York, 1901); Guiraud, *Saint Dominic* (Paris, 1901; Eng. trans., New York, 1901).

**DOMINICA**, dô-m'i-nê'kâ. A West Indian island lying in the Leeward group, between the French islands of Guadeloupe (on the north) and Martinique (on the south), being distant from each about 30 miles (Map: West Indies, G 4); it constitutes a presidency of the British Leeward Islands colony. Dominica is 29 miles long and 16 miles broad and has an area of 291 square miles. The island is picturesque and very mountainous; the highest point is Morne Diablotin (4747 feet) in the northwest; in the southeast is Morne Trois Pitons (4672 feet). The volcanic nature of the island is manifest in solfataras, thermal springs, subterranean vapors, and the famous

boiling lake. This lake, of unknown depth, lies on the side of Grande Soufrière at an elevation of 2300 feet; it is about 6 miles south of Morne Trois Pitons and about 7 miles east of Roseau. The climate is healthful. The soil is rich and well watered and produces coffee, cacao, numerous vegetables, spices, and limes and other tropical fruits. About 65,000 acres are under cultivation. Sugar, once the staple industry, is no longer of importance. The hills abound in valuable timber. In 1910 imports were valued at £147,322 and exports £112,111; in 1911, £164,695 and £124,678 (chiefly limes and lime juice, citrate of lime, and cacao). There is no railway or internal telegraph; there is a government telephone system of 425 miles. Telegraphic cables connect with Guadeloupe and Martinique. Local government is administered by an administrator, aided by an executive council of six members. Prior to 1898 the Legislative Assembly was partly elective, but in that year, upon its own initiative, the Assembly was made to consist of six officials and six nonofficials, all appointed by the Governor of the Leeward Islands. The Assembly elects two members to the Colonial Legislative Council at St. John (Antigua). In 1911-12, revenue and expenditure, £44,054 and £38,794. The population in 1881 was 28,211 (including 309 Caribs); 1891, 26,841; 1901, 28,894; 1911, 33,863 (including about 420 Caribs, of whom 170 were estimated as of pure blood). The majority of the inhabitants are negroes and Roman Catholics; about two-thirds speak a French patois. The capital is Roseau (pop., 6577), a fortified town and port on the southwest coast. Dominica was discovered by Columbus in 1493, on November 3, a Sunday (*dies dominica*, 'the Lord's day,' whence its name). It was included in the grant made by Charles I in 1627 of various Caribbean islands to the Earl of Carlisle, but the first settlers were French (1632). The treaty of Aix-la-Chapelle (1748) provided that the island, along with some others, be neutral and remain in the possession of the native Caribs. But French planters, with negro slaves, established themselves in increasing numbers, and the island came under the rule of a French governor. It was captured by the British in 1756, and British and French authority alternated until 1783, when British rule was definitely established. A French invasion occurred in 1795 and another, under General La Grange, in 1805, the latter being the most memorable event in the history of the island. In 1833 Dominica and the other British Leeward Islands were formed into a general government under a governor in chief resident in Antigua, and under an Act of 1871 it became a presidency of the Leeward Islands colony.

**DOMINICALE**, dô-mîn'i-kâ'lê, or **DOMINICAL** (ML., from *dominicus*, relating to the Lord, from *dominus*, lord). A rare term, probably denoting a white linen cloth in which at communion, during the early ages of the Western church, women received the sacred host ("the body of the Lord," hence the derivation), which as late as the eighth or ninth century was placed in the hand of the communicant, not in the mouth as in modern Roman Catholic usage. It is sometimes applied to a veil worn by women in church.

**DOMINICAL LETTER**, or **SUNDAY LETTER**. One of the seven letters A, B, C, D, E,



F, G, used in calendars to mark the Sundays of the year. The first seven days of the year being marked in their order by the above letters, the following seven, and all consecutive sets of seven days to the end of the year, are similarly marked: so that the 1st, 8th, 15th, 22d, etc., days of the year are all marked by A; and the 2d, 9th, 16th, 23d, etc., by B; and so on. The days being thus marked, it is evident that, on whatever day the first Sunday of the year falls, the letter which marks it will mark all the other Sundays in the year, as the number of the letters and of the days in the week is the same.

As the common year consists of 52 weeks and one day over, the dominical letters go backward one day every common year. If the dominical letter of a common year be G, F will be the dominical letter for the next year. As a leap year consists of 52 weeks and two days, the letters go backward two days every leap year. If in the beginning of a leap year the dominical letter be G, E will be the dominical letter for the next year. This extra retrocession, however, is made to take place at the intercalary day (the 29th of February) by the artificer marking it by the same letter as the day which preceded it, and thus the next Sunday is marked by the letter preceding that which marked the Sundays before the intercalary day. Suppose the 28th of February in a leap year to be a Sunday, and marked by F, it is evident that the dominical letter for the rest of the year will be E. In the Catholic ecclesiastical calendar February 24, instead of 29, is counted twice. As every fourth year is a leap year, and the letters are seven in number, it is clear that the same order of letters must return in four times seven, or 28 years, which would, but for the leap years, recur in seven years, and hence the solar cycle. (See PERIOD.) The Romans divided the year into *nundinae*, periods of eight days each, marked by the first eight letters of the alphabet. When, in the time of Augustus, the week of seven days was introduced, the first seven letters only were needed. The device was useful to the Christian as a means of determining the day of the month on which a feast falls in any year. (See EASTER.) Rules and tables for finding the dominical letters are given in prayer books, breviaries, etc., as well as in works on dates. Consult Woodman, *Perpetual Ecclesiastical Calendar* (New York, 1906).

**DOMINICAN REPUBLIC.** See SANTO DOMINGO.

**DOMINICANS, or ORDER OF PREACHERS.** An order of preaching friars (the Latin name is *Ordo Prædicatorum*) in the Roman Catholic church. It was founded by St. Dominic (q.v.) in 1215, for the purpose of counteracting, by means of preaching and teaching, the tendency of the times to break away from the church. When in Rome seeking confirmation for his order, which was delayed on account of the opposition of the Fourth Lateran Council, just concluded, to the multiplication of new religious organizations, the founder met St. Francis of Assisi, who was engaged in a similar work. A cordial friendship sprang up between the two men, different as they were in temperament; to this day its memory is preserved in the custom of the priests of each order celebrating the feast of the founder of the other in his own church. Both orders differed from the older ones in

more strictly the spirit of poverty and rejecting the possession of even community property. Hence they are called mendicant orders, as they originally depended for their subsistence entirely on the daily charity of their neighbors. The name of monks is often incorrectly applied to them; the proper designation of both Franciscans and Dominicans is friars (Lat. *fratres*, 'brothers'). The requisite papal confirmation was obtained from the new Pope, Honorius III, at the end of 1216; with it went special privileges, especially the right to preach and hear confessions everywhere, without local authorization. The first house of the order was at Toulouse, from which in the summer of 1217 Dominic sent some of his 16 associates to spread the movement in Spain and France. From the name of their first convent of Saint-Jacques in Paris, they were popularly known in the latter country as Jacobins—a name which was to acquire a new and sinister significance in the Revolution. They were introduced into England within six years and founded a house at Oxford. Here they were known as "Black Friars," from the habit which they wear outside the convent, in preaching and in hearing confessions—a black cloak and hood over a white woolen undergarment. "The monks," writes Matthew Paris, a Benedictine, "did not in three or four hundred years ascend to such a height of greatness as the friars minor and preachers, within 24 years after they began to build their first house in England." (Consult Jessopp, *The Coming of the Friars*, London, 1888.) Their progress was scarcely less rapid in Scotland, where they found a munificent patron in King Alexander II, who is said to have met St. Dominic in Paris. They soon spread as far as Russia and Greece and in 1280 even to Greenland.

In accordance with the declared purpose of their foundation, the Dominicans have always been known as diligent preachers and strenuous combatants against any departure from the teaching of their church. In this capacity they were intrusted with the conduct of the Inquisition as an ecclesiastical institution, and even in Spain, after it became practically a department of civil government, a Dominican was usually at its head. The office of master of the sacred palace, endowed with great privileges by Leo X, has always been held by a member of the order, and since 1620 the censorship of books has been one of its functions. In 1425 the permission to hold property was granted by the Pope to certain houses, and extended to the entire order in 1477, since which time they have been less exclusively a mendicant order. They have furnished four popes (Innocent V, Benedict XI, Pius V, and Benedict XIII), and more than 60 cardinals. Outside of their specific work, they did much for the development of art. Their cloister at Santa Maria Novella, in Florence, was a veritable school of architecture. Painting was also cultivated with great success at San Marco in the same city and at Santa Caterina in Pisa; and the names of Giovanni da Uccello, better known as Fra Angelico, Benedetto da Mugello, and Bartolommeo della Porta are worthy of remembrance. (Consult Marchese, *Memorie dei più insigni pittori, scultori e architetti domenicani*, Bologna, 1878.) Their chief glory in theological learning is St. Thomas Aquinas (q.v.), whose teaching has been especially commended by Leo XIII as the standard



of dogmatic theology; other distinguished teachers were Albertus Magnus and Raymond of Peñaforte, the third general of the order. Their great rivals in the later Middle Ages were the Franciscans. These two orders divided the paramount influence in the church, and often in the Catholic states, not without frequent hostility on the part of the parochial clergy, who felt their rights invaded by the friars; but the rise of the Jesuits lessened their power both in the schools and in the court. In the eighteenth century they possessed not less than 1000 houses in all parts of the world. The troubles of the latter part of that century, however, decreased their number considerably. In France the order was revived largely through the efforts of the famous Lacordaire (q.v.), the centenary of whose birth was solemnly celebrated in 1902 as that of "the restorer of the Dominican Order in France." In England and Ireland they have 21 houses for men and 13 for women. They played the leading part in the evangelization of Spanish America. Introduced into the United States in 1805, they now have 20 houses for men, while the Dominican sisters have 24 mother houses, each with several succursal houses. At the head of the whole order stands the general (*magister generalis*), whose term of office since 1862 has been 12 years; since 1273 he has had his residence at Santa Maria Sopra Minerva in Rome. There are 52 provinces (each with a provincial at its head), though some of these are now merely nominal.

The female branch of the order may claim, in a sense, greater antiquity than the male, since Dominic founded his house at Prouille in 1206; but after the friars were established, the members of his community modestly called themselves the second order. Another house was founded at Rome in 1218, Dominic being commissioned to unite a number of small or private associations in the authorized system of his rule. The cloister of San Sisto, given him by the Pope for this purpose, is thus really the first in which the Dominican habit was worn by women. The order was originally intended to be contemplative, but in later years, together with some relaxations of the rule, its scope was extended so far as to include the education of girls and other practical works. The nuns are not numerous, since the revolutionary movements of the latter part of the eighteenth century destroyed the greater part of their houses; but a certain number of new convents has sprung up in the nineteenth century, especially in Bavaria. The third order was organized by St. Dominic in 1220, to provide a constant supply of defenders of the church against the assaults of the Albigenses and other turbulent innovators. He gave it the name "militia of Jesus Christ," and pledged its members to defend the church with their arms and their possessions. Married men could not be received into the brotherhood without the consent of their wives, who were bidden to pray for the success of the men. The enthusiasm of the Middle Ages soon brought large numbers, to whom the founder gave a few simple rules for holy living. After the necessity of this militant life passed away, the members were unwilling to dissolve their association and continued it as against spiritual foes, naming themselves "brothers and sisters of penance." Their numbers increasing rapidly, the seventh general of

the order, Munio de Zamora, reduced the rules given by the founder to a systematic form, in which they were confirmed by Pope Innocent VII in 1405 and Eugenius IV in 1439.

Some members have maintained a cloistered life, but the majority have been men and women living a devout life in the world. The third order has produced numerous saints, including St. Catharine of Siena, and the first American saint, Rose of Lima. According to the official Catholic Directory in 1914 there were in the United States and Philippines 242 Dominican fathers, 123 clerical students, and 35 lay brothers. On the history of the Dominicans in general, consult: Caro, *Saint-Dominique et les Dominicains* (Paris, 1853); Danzas, *Etude sur les temps primitifs de l'ordre de Saint-Dominique* (ib., 1874 et seq.); Drane, *The Life of St. Dominic, with a Sketch of the Dominican Order* (3d ed., London, 1891); Proctor (ed.), *Short Lives of the Dominican Saints* (New York, 1901); *Monumenta Ordinis Fratrum Prædicatorum Historia* (Stuttgart, 1900 et seq.). For further details of both Dominican and Franciscan third orders, see TERTIARY.

**DOMINIE** (dō'mī-nē) **SAMPSON**. A faithful schoolmaster in Scott's *Guy Mannerling*.

**DOMINION**. A town in Cape Breton Co., Nova Scotia, Canada, 13 miles from the Sydney and Louisburg Railway, and connected by electric railway with Sydney, B. N. S. and Glace Bay. Collieries of the Dominion Coal and Iron Co. are located here. There are an amount and water-works system. The town was founded about 1905. Pop., 1901, 1546; 1911, 2589.

**DOMINION, THE OLD**. Virginia. See STATES, POPULAR NAMES OF.

**DOMINION OF CANADA**. See CANADA, DOMINION OF.

**DOMINIQUE**, dōm'i-nēk. A breed of domestic fowls very similar in plumage to the barred Plymouth Rocks. Both cocks and hens have rose combs and bright yellow legs. They have excellent qualities and weigh from 6½ to 8½ pounds.

**DOMINIQUE**. See DOMINICA.

**DOMINIS**, dō'mē-nēs, MARCO ANTONIO DE (1566-1624). An Italian ecclesiastic. He was born on the island of Arbe, on the coast of Dalmatia, and was educated by the Jesuits at Loretto and Padua, winning distinction by his ability and the varied character of his studies. He taught mathematics at Padua and logic and rhetoric at Brescia. He finally refused to become a Jesuit and for several years was a popular preacher. In 1596 he was appointed Bishop of Segni in the State of Venice, and in 1598 Archbishop of Spalatro and Primate of Dalmatia and Croatia. He quarreled with the Pope and, having exhibited certain Protestant leanings, found it expedient to resign his post. In 1616 he went to England and, as a convert from Catholicism, was well received. James I appointed him dean of Windsor and master of the Savoy in 1617. The same year he published the first part of his great theological work, the *De Republica Ecclesiastica contra Primum Papæ*, in which he endeavored to show that the Pope had no supremacy over other bishops, but was merely *primus inter pares*. He also published in England Sarpi's *Historia del Concilio Tridentino*. For a time he posed as a violent opponent of Catholicism. But in 1620 he began to negotiate a return to his old faith.

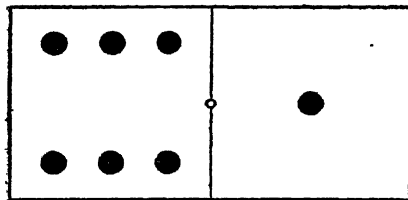
He arrived at Rome in 1622 and was well received at first, but a charge of heresy was brought against him in 1623. He was imprisoned in the castle of Saint Angelo and died there Sept. 28, 1624. Being subsequently condemned as a heretic, his body was raised from its grave and burned, with his portrait and books, Dec. 21, 1624. In his *De Radiis Visus et Lucis in Vitris Perspectivis et Iride* (1611), written while he was at Padua, Dominis was the first to approximate to the true scientific explanation of the rainbow. His *Reasons for Leaving the Church of Rome* is translated in Somer's *Tracts*; his *Motives for Renouncing the Protestant Religion* (1623) was published in English translation (1627). Consult *A Relation Sent from Rome of the Process, Sentence, and Execution Done upon the Body, Picture, and Books of Marco Antonio Dominis after his Death* (1624).

**DOMINIUM** (Lat., lordship). At Roman law, *dominium* meant ownership, or private right over a thing, whether immovable or movable. More precisely *dominium* was the general right, as opposed to any special right, such as servitude or lien. It included the power of use and enjoyment, of alienation and of testamentary disposition; but limitations were, as in modern law, imposed upon the owner in his own interest (e.g., in case of infancy or insanity) or in the interest of neighbors or of the public generally. As regards slaves, restrictions were imposed upon the owner in the interests of humanity. In the technical sense *dominium* was ownership vested by the old civil law (*ex jure Quiritium*), as opposed to the substantially equivalent right created by the later, prætorian, law—a distinction similar to that between legal and equitable ownership in English and American law. (See **CIVIL LAW**; **USES**; **TRUST**.) It was said that the prætor could not grant ownership, but only possession of the property (*bonorum possessio*), and that the ownership remained with the civil-law owner, although his title was a naked one (*dominium nudum*). *Dominium*, at Roman law, was never confused with *imperium*, or sovereignty; and when it was said that the lands of conquered subjects of Rome were in the *dominium* of the Roman people, this meant that, in legal theory, the land was owned by the Roman people, and that the provincials were merely possessors, holding at the pleasure of the Roman people. *Dominium* could be held by two or more persons jointly, but in such case the joint owners (*condomini*) were always coproprietors with similar rights. Ownership could not be so divided that different powers should be attributed to different persons and each be regarded as *dominus*. During the Middle Ages, however, the right of the feudal superior to a fief was described as direct ownership (*dominium directum*), and the right of the vassal in possession was termed beneficial ownership (*dominium utile*). In connection with the base tenures, also, the same terms were respectively applied to the right of the landlord and the right of the tenant. To the supreme feudal lord was attributed eminent domain (*dominium eminens*). These uses of the word *dominium* were due to the feudal confusion of political with proprietary powers, and with the dissolution of the feudal system this ambiguity disappeared; but the term "eminent domain" has been retained to describe the exercise of govern-

mental authority over property, particularly for the purpose of expropriation of the property for public use. By writers on international law *dominium* has been used in the sense of sovereignty, and the whole doctrine of acquisition and loss of sovereignty over territory was worked out by Grotius and his successors, under the head of *dominium*. In this process many rules were derived, by analogy, from the rules of the Roman law . . . isition and loss of ownership. . . . **DOMAIN**; **FEUDALISM**; **PROPERTY**. Consult the authorities referred to under **PROPERTY**; **INTERNATIONAL LAW**; **CIVIL LAW**.

**DOMINO**. See **MASK**.

**DOMINOES** (so called, apparently, from the color of the back of the pieces, which is black, like a domino). A game, partly of chance and partly of skill, played by any number of people from two to a dozen, but most often by two, with 28 oblong pieces of ivory, bone, or wood, plain black on the back and white on the front marked with black dots in two divisions on the front, one set of dots on one side of a line dividing the centre, and the other on the opposite side of the line. One of these dominoes is



A DOMINO.

blank on both divisions, the remainder are numbered from double six; i.e., six in each division, down through the scale, 6-5, 6-4, 6-3, 6-2, 6-1, and so on, 5-5, 5-4, 5-3, 5-2, 5-1, through all the other numbers. Before beginning to play, the 28 pieces are turned face downward and shuffled or mixed up on the table so that the position of no special piece can be recognized. Then, according to the particular game about to be played, the whole, or a certain proportion of the dominoes, is selected, one at a time, by the respective players. Each player sets his dominoes up on edge so that they cannot be seen by the opponent, and examines their markings. Whatever dominoes are not drawn form the stock or reserve. The first player places one piece face upward on the table, and his opponent must place against it "a match," i.e., a piece out of his hand corresponding in pips at one end or the other with the piece laid down. Then the first player (in a two game) must in his turn match, or pose, from his hand, a domino to meet the new combination of pips—there being always two ends for him to select to match. If he has no number corresponding to either end, he "passes," and the opponent plays again; or, if he is playing the "draw" game (a game in which less than the whole number of dominoes was originally dealt), he may draw on stock up to, but never including, the last two dominoes. Thus the game goes on until one of the players has put out all his dominoes and can neither "match" nor "draw." The one who has the smallest number of pips on his unexhausted dominoes wins, or, in case of an equality of pips, he who has the fewest

dominoes left wins. The other varieties of the game are the "draw game," and its variation "matador"; "the block game" and its variations; "muggins," or "all fives," "all threes," "Sebastopol," "the Bergen game," "domino pool," and various other miscellaneous games. The game was not known in Europe until the middle of the eighteenth century, but it has spread all over the world. Consult *Foster's Complete Hoyle* (New York, 1909).

**DOMINUS** (Lat., lord). 1. At Roman law, the owner, the person who holds *dominium* over a thing—including, of course, the master of a slave. 2. In Roman popular speech, a form of respectful address, like our "sir." 3. In the Imperial period, a title given to the Emperor. In the early Empire, however, the use of this title was thought servile, and to demand it or even permit it was considered despotic. See **DOMINIUM**.

In legal phraseology, the *dominus litis* is the person really interested in the issue of an action, though not necessarily the nominal plaintiff (*actor*) or defendant (*reus*).

**DOMITIA** (dō-mish'ī-a) **GENS** (Lat., Domitian family). A plebeian family in Rome, famous under the later Republic. It had two branches—the Calvini and the Ahenobarbi. Of the latter branch, the Emperor Nero was the last male representative.

**DOMITIAN**, dō-mish'ī-an. **TITUS FLAVIUS DOMITIANUS** (51-96), Emperor of Rome from 81 to 96 A.D. He was the son of Vespasian, and younger brother of Titus, whom he succeeded on the throne. The earlier years of his reign were, on the whole, advantageously occupied for the public benefit. Many good laws were passed, the provinces were carefully governed, and justice was rigidly administered. As he grew older, however, his ambition, his jealousy, and his pride, wounded by the failure of his campaigns against the Dacians (who were led to victory by their King, Decebalus, q.v.) and the Marcomanni, and by the revolt of Antonius Saturninus, who commanded the armies in Upper Germany, began to instigate him to the most atrocious cruelties. By murder or banishment he deprived Rome of nearly every citizen conspicuous for talent, learning, or wealth. He won the army by greatly increasing the pay of the soldiers and secured the favor of the people by prodigal largesses and gladiatorial shows and games, in which he sometimes took part in person. His cruelties became at length so intolerable that a conspiracy, encouraged by his wife, Domitia, whom he had doomed to death, was formed against him, and the tyrant was assassinated. Consult Imhoff, *T. Flavius Domitianus* (Halle, 1857), and Gsell, *Essai sur le règne de l'empereur Domitien* (1894).

**DOM'NUS, POPE**. See **DONUS**.

**DOMODOSSOLA**, dō'mō-dōs'sō-lā (ancient Oscela). A picturesque town at the Italian end of the Simplon Pass, on the Toce (Map: Italy, C 1). The adjacent Mount Calvary, which commands an inspiring view, is covered with small chapels that are visited by many pilgrims. The principal industries are raising fruit, making wine, and the manufacture of silk and leather. Pop., 1901, 5016; 1911, 6421.

**DOMRA** (a corruption of the Russian *bandurra* from the Gk. *πανδούρα*, *pandoura*, a lyre with three strings). A Russian stringed instrument with a large belly and long neck. From it the balalaika (q.v.) was developed.

Since Anadreef made balalaika orchestras popular in Russia, the domra is built in larger sizes and serves as the bass of those orchestras. Consult A. Faminzin, *The Domra and Related Musical Instruments* (St. Petersburg, 1891, in Russian), and K. Schlesinger, *History of Musical Instruments* (London, 1912).

**DOMREMY - LA - PUCELLE**, dōn'rā'mē'lā-pū'sēl' (Fr., Domremy of the Maid; so named in honor of Joan of Arc). A village in the Department of Vosges, France, on the left bank of the Meuse, about 7 miles north of Neufchâteau. It is famous as the birthplace of Joan of Arc, whose cottage, adorned with the royal arms of France and those of the family of the heroine, is still in existence. There is a bronze statue of Joan by E. Paul in front of the church. The modern basilica of Le Bois Chenu with a statue of Joan by Allar, on a hill near the village, marks the spot where the Maid of Orléans received the spiritual mission to deliver her country from the enemy. The interior contains mural decorations of the six stages in the life of Joan by J. P. Laurens. The village was freed from all taxes by Charles VII on account of its brave daughter and enjoyed this privilege until the Revolution. A yearly pageant representing the life of Joan is given by the people of the village. Pop., 1901, 308; 1911, 267.

**DON**. A river of south Russia, rising in a small lake in the Government of Tula (Map: Russia, F 5). It flows in a general southeasterly direction, through the governments of Tula, Ryazan, Tambov, and Voronezh, and, after describing an arc across the Province of the Don Cossacks, where it approaches within 37 miles of the Volga, it enters the Sea of Azov at the town of the same name. Its total length is over 1300 miles, of which 800 are navigable. Its breadth varies between 500 and 1850 feet. In its upper course the Don flows through a low country, which is subject to overflow in the spring. The lower course is through a more elevated region. The chief tributaries of the Don are the Donetz and the Sosna on the west, and the Voronezh, Chover, Medveditza, and Manitch on the east. The Don is connected with the Volga by a canal. The river is very rich in fish; the freight carried by it consists chiefly of grain, lumber, and cattle. The principal port is Rostov. The Don is the Tanais of the ancients.

**DON, or DUN**. A river of the West Riding of Yorkshire, England, rising in the moors on the borders of Derbyshire and Cheshire (Map: England, E 3). It flows 55 miles, first south-east to Sheffield, and then northeast by Rotherham, Doncaster, and Thorne, to its junction with the Ouse at Goole. Its chief tributaries are the Rother, Dearne, and Wentle. It is navigable for the last 39 miles of its course below Sheffield, by the aid of canals.

**DON**. A river of Aberdeenshire, Scotland, rising in a peat bog on the borders of Banffshire, nearly 2000 feet above sea level, and entering the North Sea a mile northeast of Old Aberdeen (Map: Scotland, F 2). It has a total course of 78 miles. It is noted for its salmon fisheries. Its chief tributary is the Ury.

**DONA FRANCISCA**. A German settlement in the State of Santa Catharina, Brazil, founded in 1851 by a German colonization society. It covers an area of about 550 square miles and had in 1900 a population of nearly 25,000. Chief town, Joinville, with about 3000

inhabitants. Consult Gernhardt, *Dona Francisca, Hansa und Blumenau drei deutsche Mustersiedlungen im Santa Catharina* (Breslau, 1901).

**DONAI**, dōn'ī, or **DONNAI**. A river in southeastern French Indo-China, rising in the highlands near the coast in about lat. 12° N. It flows generally towards the southwest, discharging its waters through a delta, which is a continuation of the north outlet of the Mekong. Saigon, the capital of Cochinchina, is on its banks.

**DONALDSON**, EDWARD (1816-89). An American naval officer. He was born in Baltimore, entered the navy as midshipman in 1835, and became lieutenant in 1847. In 1862, as commander of the *Scioto*, he took part in the bombardment of Forts Jackson and St. Philip, in Farragut's capture of New Orleans, and was raised to the rank of commander. He also participated in the battle of Mobile Bay. He became a captain in 1866, a commodore in 1871, and a rear admiral in 1876, when he was retired from the service.

**DONALDSON**, HENRY HERBERT (1857- ). An American neurologist, born in Yonkers, N. Y. After graduating from Yale University in 1879 he studied at Sheffield Scientific School (Yale), at the College of Physicians and Surgeons (Columbia University), and at Johns Hopkins, where he was instructor in biology (1883-84) and associate professor of psychology (1887-88). He was assistant professor of neurology (1889-92) at Clark University and professor and head of the department of neurology (1892-1906) and dean of the Ogden (Graduate) School of Science (1892-98) at the University of Chicago. In 1906 he became professor of neurology at the Wistar Institute of Anatomy and Biology, Philadelphia. He is the author of *The Growth of the Brain* (1895); "The Physiology of the Central Nervous System," in *An American Text-Book of Physiology* (1896); *On the Weight of the Crania of Norway and Albino Rats* (1912); and articles in scientific journals.

**DONALDSON**, SIR JAMES (1831- ). A Scottish educator and author. He was born at Aberdeen, was educated at Aberdeen University, New College, London, and Berlin University, and was appointed tutor in Greek at Edinburgh University in 1852. He afterward became rector of the high schools of Stirling (1854-56) and Edinburgh (1866-81), where he had previously been classical master for 10 years. In 1881 he was appointed professor of humanity at Aberdeen University, and in 1890 he became vice chancellor and principal of the University of St. Andrews and principal of the United College of St. Salvador and St. Leonard. He was knighted in 1907. His publications include the following: *A Modern Greek Grammar for the Use of Classical Students* (1853); *Lyra Græca*, specimens of Greek lyric poetry, ancient and modern (1854); *Critical History of Christian Literature and Doctrine from the Death of the Apostles to the Nicene Council* (3 vols., 1864-66); *The Ante-Nicene Christian Library*, in collaboration with Professor Roberts (24 vols., 1867-72); *Expiatory and Substitutory Sacrifices of the Greeks* (1875); *Woman: Her Position and Influence in Ancient Greece and Rome, and Among the Early Christians* (1907); *Addresses Delivered in the University of St. Andrews from 1886 to 1910* (1911).

**DONALDSON**, JAMES LOWRY (1814-85). An

American soldier. He was born in Baltimore, Md., graduated at West Point in 1836, and served with distinction in the Florida and Mexican wars. He was chief quartermaster of the Department of the Cumberland and then of the Military Division of Tennessee during the Civil War, and at its close was brevetted major general in the regular army. He retired from active service in 1869 and resigned from the army in 1874. He wrote *Sergeant Atkins* (1871), a tale of the Florida War.

**DONALDSON**, JOHN WILLIAM (1811-61). An English classical scholar, born in London. He was educated at the University College, London, and at Trinity College, Cambridge, from which he received the degree of B.A. in 1834. In 1835 he was elected fellow. His first work was as reviser of Buckham's *The Theatre of the Greeks*, which passed through eight editions, but is now antiquated. In 1839 he published his *New Cratylus*, which is remarkable as being the first attempt, on a large scale, to familiarize Englishmen with the principles of comparative philology, as established by Pott, Bopp, Grimm, and others in Germany. Donaldson in 1841 accepted the post of head master of the grammar school at Bury St. Edmunds, having previously taken orders. In his duties as head master, he found time to prosecute his linguistic studies, embracing Hebrew and Arabic and many of the languages of modern Europe. In his *Varronianus*, of which the first edition appeared in 1844, he undertook to accomplish for Latin philology what he had done for Greek in the *New Cratylus*. Among his other works of this period are an edition of Pindar, of the *Antigone* of Sophocles (with a verse translation), *Maskil le Sopher* (a treatise on Hebrew grammar), and finally *Jashar* in 1854, a book written in Latin and published at Berlin, the object of which was, by critical tests, to distinguish the remains of early Hebrew songs embedded in the Masoretic text of the Old Testament. This book was violently assailed by the religious press for its free handling of the text, but reached a second edition.

He resigned his place at Bury St. Edmunds in 1855 and returned to Cambridge. Here he wrote a volume entitled *Christian Orthodoxy*, in answer to the critics of *Jashar*. This also was violently attacked. A smaller volume on classical scholarship followed. He had previously issued a *Greek Grammar* and a *Latin Grammar* for the use of schools. These, during his residence at Cambridge, he recast and enlarged. In 1856 he was appointed one of the classical examiners in the University of London. In 1858 appeared his *History of the Literature of Ancient Greece*, in three volumes, the first two of which are a translation from the German of K. O. Müller. He was engaged in superintending the compilation of a new *Greek Lexicon*, when his health failed. Consult Garnett in *Dictionary of National Biography*, vol. xv (1888).

**DONALDSON**, THOMAS LEVERTON (1795-1885). An English architect and writer, born in London. In 1811 he entered his father's office, won a Royal Academy medal in 1817, in 1818 began his travels in Italy and Greece, and in 1882 was elected to the Academy of St. Luke, Rome. He was one of the founders of the Institute of Architects, of which he was in 1864 elected president, and from 1841 to 1864 was

professor of architecture at University College (London). He obtained a French medal of the first class in 1855, the Belgian order of Leopold in 1872, and was elected a member of the French Institute. Structures designed by him include University Hall, the Library and Laboratory of University College, London; and the Scottish Corporation Hall. He published: *Pompeii* (2 vols., 1827); *A Collection of the Most Approved Samples of Doorways from Ancient and Modern Buildings in Greece and Italy* (1883); *Handbook of Specifications for Practical Guide to the Architects* (2 vols., 1859); edited a supplementary volume to Stuart and Revett's *Antiquities of Athens*, and collaborated on the Architectural Publication Society's *Dictionary of Architecture*.

**DONALDSONVILLE.** A town and the county seat of Ascension Parish, La., 64 miles by rail above New Orleans, on the Mississippi River, at the commencement of the Bayou Lafourche, and on the Texas and Pacific Railroad (Map: Louisiana, D 3). It is primarily a commercial centre, with extensive sugar, rice, lumber, and cotton interests. The government is administered by a mayor and two commissioners, elected every four years. The power of recall is vested in the people. The town owns and operates the water works and electric light plant. Donaldsonville was settled about 1760 and was incorporated in 1806. In the battle of Fort Butler, in 1863, Donaldsonville was bombarded and burned by Federal troops, aided by Farragut. The town was almost completely destroyed. Pop., 1900, 4105; 1910, 4090.

**DONALITIUS**, dön'a-lish'i-üs, CHRISTIAN (1714-80). A Lithuanian poet. He was born in East Prussia and, three years after his graduation at Königs-berg, was appointed rector at Stallupönen (1740). He died at Tolmingkehmen, where he had obtained a pastorate in 1743. His poems enjoy high rank among the very meagre products of artistic verse in the Lithuanian language. They include six fables in hexameters. Donalitiuus' works were published by Schleicher (1865, with Lithuanian-German commentary); and Nesselmann (1869, with a German translation and a glossary). Another German translation appeared in 1893 (by Passarge, at Halle). Consult his biography by F. Tetzner in *Altpreuussische Monatschrift* (1897, pp. 227-331, 409-441; 1899, pp. 305-310).

**DON'AR.** Teutonic equivalent of the Scandinavian Thor.

**DONAT.** See DONATUS, ÆLIUS.

**DONATELLO**, or **DONATO**, dö-nä'tò (c. 1386-1466). The most important Florentine sculptor of the early Renaissance, who, more than any other, may be considered the founder of modern sculpture. He was born at Florence, probably in 1386, the son of Niccolò di Betto Bardi, a wool comber who had been involved in the uprising of the Ciompi and exiled from Florence in 1378. As he returned in 1380, it is likely that Donatello was brought up in his father's house and not in that of the Martelli (as was traditionally supposed). His mother continued to live with her bachelor son until her death at 80. Nothing is known of his boyhood or first master in sculpture. In a contract of 1403 he is mentioned as among Ghiberti's assistants on the baptistery portals. He was certainly influenced by his association with his friend Brunelleschi (q.v.), the architect, with whom, following Vasari's account, it is

supposed that he visited Rome in the early years of the century to study the ancient monuments. More recent authorities, however, judging from the stylistic qualities of his work, deny this first Roman visit.

Donatello was the most prolific sculptor of the Renaissance, and it will be possible to mention only his principal works. Those executed before 1425 belong to what may be called his formative period, in which he shows strong reminiscences of the Gothic, but with increasing classical and realistic tendencies. Of his marble statues for the exterior of the church of Or San Michele, "St. Mark," executed in 1411-12 for the Linen Drapers, is an admirable figure of noble proportions in an easy position, and set off with graceful drapery. "St. George," completed in 1416 for the Armorers, now in the Museo Nazionale, is the most attractive work of his early period. The face of the youthful hero is strong and gentle; his bearing expresses determination, but without constraint.

During the same period Donatello was occupied with a number of statues for the cathedral of Florence. Among these were "John the Evangelist" (1415), the prototype of Michelangelo's "Moses," and a colossal "David" (1416), now in the Museo Nazionale. These works showed classical tendencies, but at the same time he created others of a pronounced realistic character, as, e.g., the so-called "Poggio" (1412), in the cathedral, and especially in the figures for the campanile, "Joshua" (1412), "John the Baptist" (1416), the so-called "Habakuk," "Jeremiah," and the famous "Zuccone" (Baldhead), erroneously called "David"—an old man of unusual ugliness, though the statue is wonderfully strong and lifelike and was Donatello's favorite. In these statues, excepting the last two, he was aided to some extent by assistants. All show a remarkable knowledge of sculptural perspective. Mention should here be made of the famous sandstone Marzocco (1418-20)—the lion of Florence; of the beautiful marble tabernacle on the exterior of Or San Michele, now containing Verrocchio's "Christ and St. Thomas." The statue of St. Louis, which it formerly contained—his first work in bronze—is now in Santa Croce, where is also the wooden "Crucifix" celebrated in Vasari's anecdote. Mention should also be made of the painted bust of Niccolò da Uzzano, a realistic portrait (the first of its kind in the Renaissance), in the Museo Nazionale, but assigned by some critics to a later period.

The second period of Donatello's art (1425-43) begins with his association with the architect and sculptor Michelozzo, and this date marks the beginning of his second period. Generally speaking, Michelozzo furnished the architectural designs and also assisted in bronze casting, in which his associate was inexperienced. It should be noted, however, that the latter speedily acquired a mastery of decoration, which became of great importance in the development of the Renaissance. Their first joint work was the monument to Pope John XXIII (1425-26) in the baptistery of Florence. Under a marble canopy, with a relief of the "Madonna and Child," lies the bronze effigy of the Pope, by Donatello. Below is the sarcophagus, carved with two angels bearing the inscription. The beautiful marble base contains three statues—"Faith," "Hope," and "Charity," of which the first is by Michelozzo. Of their other joint



**DONATELLO**

STATUE OF "ST. GEORGE," FROM THE SCULPTURE NOW IN THE NATIONAL MUSEUM, FLORENCE





works, the monument of Cardinal Brancacci, in Sant' Angelo, Naples, and that of Bartolomeo Aragazzi in the cathedral of Montepulciano, were chiefly done by Michelozzo (q.v.). The excellent relief of the "Ascension," of the former, is by Donatello. He also executed other bronze works, which Michelozzo cast for him; in 1426 a sepulchral slab for the Bishop of Grosseto, in the cathedral of Siena, and in 1427 a relief for the font of the baptistery there, representing "Salome's Dance"—the first really sculptural bronze relief (Ghiberti's were pictorial) of the Renaissance. For the Siena baptistery also he modeled two dancing bronze angels, which, with two others in Berlin and Florence, are the first of the kind of the Renaissance. His association with Michelozzo ceased when the latter accompanied the banished Cosimo de' Medici to Venice in 1433.

In the same year Donatello went to Rome, at the invitation of the sculptor Simone, whom he assisted in the decorations for the coronation of the Emperor Sigismund. The works executed during his stay at Rome show a greater than usual influence of classic art upon him. Chief among them is the Ciborium in the sacristy of St. Peter, decorated with reliefs of two "Worshipping Angels," and a fine "Burial of Christ." Meanwhile, in 1434, his friend Cosimo de' Medici had returned in triumph to Florence, and Donatello returned about the same time. He was employed in decorating the court of the Medici Palace with eight medallions—copies of antique gems—which were executed by his pupils. About the same time he designed his bronze "David" for Cosimo—the first nude statue of the Renaissance—now in the Museo Nazionale. About this time also he carved the sandstone relief of the Annunciation, in the Cavalcanti Chapel, Santa Croce, Florence, in which the antique influence is very marked, and the action is wonderfully rendered.

Between 1434 and 1438 he executed the exterior pulpit of the cathedral of Prato, the reliefs of which, representing "Dancing Angels," are of a lively, decorative effect, and were designed by Donatello, although their imperfect execution points to the work of his pupils. During the same time (1433-38) he completed his reliefs for the organ gallery of the cathedral of Florence (1440), a counterpiece of the similar subject by Luca della Robbia (q.v.). It is full of energy and dramatic action, the exaggerated motion and sketchy execution being calculated for an elevated position. Ruberto Martelli was also an appreciative patron, as is evinced by a large number of Donatello's works preserved in his house. Among these was a fine coat of arms of the family, a large bronze patera, decorated with Bacchanalian scenes, now in South Kensington Museum, London, and two representations of Donatello's favorite subject, "John the Baptist"—a bust and a statue. The statue represents him as a youthful ascetic, as does also an older statue in the Museo Nazionale, but the bust, as well as a relief of John the Baptist, in the Museo, and another at Faenza, are more ideal. In his later works Donatello also represented him as the ascetic preacher of the desert in a polychrome wooden statue in the church of the Frari, Venice (1451), and in a bronze statue in the cathedral of Siena (1457).

The third period of Donatello's art (1443-66) begins with his call to Padua in 1443. His

first work there was a bronze crucifix for the high altar of the celebrated church of Sant' Antonio; in 1446 he began a whole series of bronze sculptures for a new high altar, which, long scattered through the church, were lately united in an altar. Among them are the statues of the Madonna with Saints Anthony and Francis, Daniel and Justina, Louis and Prosdociamus; and reliefs of a "Pietà," an "Entombment of Christ" (in plaster), "Miracles of St. Anthony," "Symbols of the Evangelists," and "Angels Singing and Making Music." Although designed by Donatello, these works were executed by his pupils. The "Miracles of St. Anthony," in particular, show clearness of composition and dramatic action unexcelled in his other works. In 1446 he also began a bronze equestrian statue of "Erasmo de' Narni," called "Gattamelata." Although cast in 1447 it was not erected till 1453. As the first bronze equestrian statue since antiquity, it was epoch-making in art. The rider is of dignified and noble bearing, and the heavy war horse is full of life, and no less a portrait than the rider, though the action in walking is untrue to nature. Notwithstanding the inducements offered him to remain at Padua, Donatello was unhappy away from Florence, and in 1453 he departed. After visiting Venice, Ferrara, and other North Italian cities, he returned to Florence in 1457, where he passed the rest of his life, except for a brief stay at Siena. Several important works, partly mentioned above, belong to his last period; as, e.g., the well-known "Judith and Holofernes" (Loggia dei Lanzi), the bizarre effect of which is explained by its position as a fountain, and the skeleton-like wooden "Magdalen" in the baptistery of Florence. He devoted himself chiefly to finishing his work in San Lorenzo, a foundation of the Medici. In 1428 he had executed a fine bronze sepulchral statue for Giovanni, Cosimo's father, there, and before his departure for Padua he had designed the excellent plastic decorations of the Old Sacristy. After his return he designed the sculptures of the two pulpits, which he did not live to complete. Although damaged by the additions and omissions of his pupils, the best of these reliefs still bear witness to an undiminished dramatic power and invention. He died on Dec. 13, 1466, and was buried in San Lorenzo, near his friend Cosimo de' Medici. Vasari's charming anecdotes, confirmed by what we otherwise know, picture him as a modest and lovable character, generous with money and careless of appearance.

Seldom has an artist appeared who was more revolutionary and broke more completely with the past than Donatello. His contemporaries, Ghiberti and Luca della Robbia, represent more the conservative tendencies of the age. Donatello was the great radical. They were the classicists, he the realist—a realist of the highest kind, whose works were true to nature without being slavish copies. Not that he was deficient in knowledge of the antique; he was trained, especially at Rome, in the antique and (as in the bronze "David") he deliberately adapted poses taken directly from it. But his realistic trend was too strong to be much restrained by antique models. He deliberately sacrificed beauty to character, which no one could portray better than he. His works also abound in dramatic action. He was an excellent technician and, whether working with bronze or marble, he gained the best effects that his ma-

terials would yield. He excelled in the treatment of flesh and was a consummate master in relief, ranging through its entire scope and reaching the plastic effect, as was done by Michelangelo in his last period, however, his compositions became overcrowded, and the action is exaggerated. No other artist of the day understood perspective in sculpture as he did; Vasari records interesting anecdotes of the astonishment of the Florentines at the near and distant effects of his statues and reliefs. Of the large number of pupils formerly ascribed to him, Desiderio da Settignano (q.v.), Bertoldo in Florence, and Bellano in Padua are the only important ones of whom this can be certainly assumed. Nevertheless, his influence more than any other dominated the sculpture of Florence throughout the fifteenth century, until the culmination of Italian art in Michelangelo, his artistic descendant. It also was the inspiration of the sculpture of northern Italy, and even of the painting, as is seen in the case of Mantegna, the chief master of Padua, who copied statues of Donatello. Not only was he considered the greatest sculptor of his day, but modern criticism has confirmed this judgment, placing him among the greatest sculptors of all time.

**Bibliography.** The chief source of information for the life of Donatello is Vasari's *Vite* (ed. by Milanesi, Florence, 1878; Eng. trans., by Blashfield and Hopkins, New York, 1896), vol. i. Vasari's testimony has been much modified by recently published documentary evidence and by a sounder critique of the master's works. Among earlier biographies the best are those of Müntz (Paris, 1885) and especially, Semper (Innsbruck, 1887), probably the best authority. Others are by Schmarow (Leipzig, 1886); Cavallini (Milan, 1886), and in *Die Kunst* (Berlin, 1906); Rea (London, 1900); Pastor (Gießen, 1892); Trombetta (Rome, 1887); Angelini, Carocci, and Melani (Florence, 1887); Raymond (Paris, 1890); Meyer (Bielefeld, 1903)—the latter a popular yet very scholarly monograph (Eng. trans., London, 1904); Lord Balcarras (ib., 1903), the best English biography; Eber (Budapest, 1903); Schottmüller (Munich, 1904); Alexandre (Paris, 1905); Schubring (Stuttgart, 1907); Bertaux (Paris, 1910); Gorboff (Moscow, 1912). For certain phases of Donatello's life and art, see Gloria, *Donatello in Padova* (Padua, 1895), and Tschudi, *Donatello e la critica moderna* (Turin, 1887). The researches of Wilhelm Bode on Donatello are of fundamental importance in such works as *Die italienischen Bronzestatuetten der Renaissance* (Berlin, 1907) and *Florentiner Bildhauer der Renaissance* (Berlin, 2d ed., 1910; Eng. trans., London, 1908). An almost complete series of reproductions of Donatello's works is in Bode, *Denkmäler der Renaissance skulptur Italiens* (Munich, 1892-1905).

**DONATELLO.** A young Tuscan nobleman in Hawthorne's *Marble Faun*.

**DONATH,** dō'nät, JULIUS (1849- ). An Hungarian neurologist and psychiatrist, born at Baja, Hungary, and educated at the universities of Vienna, Innsbruck, Berlin, and Paris. He was an assistant in medical chemistry at Innsbruck (1871-74) and in chemistry at Vienna (1874-77) and a lecturer at the technical high school of Graz (1877). During the Russo-Turkish War (1877-78) he was chief physician and operator at the Turkish field hospital of

Adrianople. He was appointed lecturer on nervous diseases at the University of Budapest (1893), and (in 1902) chief physician of nervous diseases at St. Stephan-Spitals, where he also became assistant professor in 1908. Donath introduced new methods of treatment for epilepsy, progressive paralysis, and juvenile insanity. In 1890 he founded and became editor of the Hungarian medical journal *Klinikai Fuzzetek* and in 1909 also of the international quarterly *Epilepsia*. Besides numerous scientific studies in his special fields, popular-science articles, critiques, and philosophical and sociological essays appearing in the periodicals of various countries, his publications include: *Die Anfänge des menschlichen Geistes* (1898); *Bestrebung und Fortschritt in der Behandlung der Epilepsie* (1900); *Reflex und Psyche* (1910).

**DONATI,** dō-nä'tè, GIOVANNI BATTISTA (1826-73). An Italian astronomer, professor in the Royal Institute and director of the observatory at Florence. In his *Intorno alle strie degli spettri stellari* (1860) he discussed the desirability of a physical classification of stars. He discovered the gaseous composition of comets and also six new comets, one of which bears his name. See **DONATI'S COMET**.

**DONATION** (Lat. *donatio*, gift, from *donare*, to give, from *donum*, Skt. *dāna*, gift, from Lat. *dare*, Gk. *didōnai*, *didonai*, Skt. *dā*, to give). In strict legal usage, the word "donation" is confined to the transfer of personal property made without consideration; the word "gift" being at common law restricted to a particular kind of transfer of real estate—that by which there is created an estate in fee tail—an estate, i.e., which is granted to a man and the heirs of his body. In popular usage, however, the term "gift" is more commonly employed in the sense of donation, and in the United States this is its usual legal signification also. The general classification of gifts of personal property is twofold: gifts *inter vivos* (between the living), which go into effect at once and have no reference to future events; and gifts *mortis causa* (because of—i.e., in expectation of—death). This last form of gift is usually intended to avoid the necessity of making a will when circumstances render that impossible or difficult. Only personal property can pass in this way; the transfer must be made when the death of the donor appears imminent, there must be delivery of the property, and the gift takes effect only upon the death of the donor. The gift, therefore, is really a conditional one and is ipso facto revoked by the recovery of the donor, or may be recalled by him before death actually occurs. A gift *inter vivos*, on the contrary, is absolute, and not revocable. All kinds of personal property are subject to gift, including even a *chose in action*, i.e., property of which the owner has not the actual possession, but the right of possession, and which he may reduce to possession by legal action. Such a right can only be transferred by a written assignment.

A special use of the word "donation" in this country is in the expression "donation lands," which were certain lands set apart by the State of Pennsylvania after the Revolution, in the northwest part of its territory, as a gift to its citizens who had served in the Revolutionary army. See **CONVEYANCE**; **DELIVERY**; **GIFT**; **PERSONAL PROPERTY**.

The phrase *donatio propter nuptias* ('a gift on account of marriage') was used in the civil or Roman law to designate the sum paid by a husband as the offset to the wife's dowry; this was considered partly as a jointure for the wife in case of her survival, partly as security for the return of the wife's dowry to her heirs if she failed to survive her husband. See DOWER; MARRIAGE SETTLEMENT.

**DONATION OF CONSTANTINE** (Lat. *donatio Constantini*). A forged document of uncertain date, possibly published about 754 A.D., to be the record of a gift bestowed by the Great upon Pope Sylvester I. By it the Bishop of Rome was granted, besides certain marks and insignia of honor, such as the tiara, the lorum, and Imperial robes, the temporal sovereignty over "Rome and all the provinces, districts, and cities of Italy or of the western regions." The Donation of Constantine, though a very clumsy forgery, was regarded for a long time as genuine and was incorporated in the collections of Canon Law; but up to the eleventh century was never made use of to vindicate papal claims. The authenticity of the document was first seriously attacked by Laurentius Valla in 1440; it was defended by many partisans for over three centuries. Since then the controversy as to the date of the forgery has been active. A translation of the Donation is given in Henderson, *Select Historical Documents of the Middle Ages* (New York, 1892). Consult Scheffer-Boichorst, "Konstantinische Schenkung," *Monatsschrift des Instituts für oesterreichische Geschichtsforschung*, vols. x, xi (Vienna, 1889-90), and Doellinger, *Die Papstfabeln des Mittelalters* (2d ed., Stuttgart, 1890).

**DONATION OF PEPIN.** The gift of temporal sovereignty over the Exarchate of Ravenna, the Pentapolis, and the territory of Bologna and Ferrara bestowed upon the Pope by Pepin the Short, King of the Franks, in 756. In the preceding year Pope Stephen III had summoned the Frankish King to aid him against Aistulf, King of the Lombards. Pepin crossed the Alps and defeated Aistulf, but as the latter still continued hostile to the Pope, Pepin invaded Italy a second time in 756, and took from the Lombards 22 cities, the keys of which he presented to St. Peter's. In 774 Charles the Great confirmed the papacy in possession of the territories granted by Pepin and enlarged to a considerable extent the boundaries of the earlier grant. The donations of Pepin and Charles the Great laid the foundation of the temporal power of the Pope. Consult Abel, *Jahrbücher des fränkischen Reichs unter Karl dem Grossen* (Leipzig, 1883), and Schnürer, *Die Entstehung des Kirchenstaates* (Cologne, 1894). See PAPAL STATES.

**DONATI'S COMET.** A comet discovered by Giovanni Donati at Florence on June 2, 1858. When nearest the earth, its tail had an apparent length of 50°. It approached to the enormous linear size of 10,000 miles and was 10,000,000 miles wide. Its period was estimated at more than 2000 years. The comet was seen until March, 1859.

**DONATISTS.** The followers of Donatus the Great, a schismatic body of Christians in North Africa, who flourished during the fourth century. In the persecution under Diocletian (303 A.D.) the Christians had been ordered to give up their sacred books. Those who complied with this demand were called *traditores*, and the

question how to deal with them soon became a pressing one in church discipline. Should they be readmitted to church fellowship and, if so, upon what conditions? The main body of the church, led by Rome, favored a policy of mildness. But there was also a strict party, insisting that the *traditores* were unworthy, that their presence would corrupt the body ecclesiastic, and that any priestly functions which they might perform would be ipso facto null and void. For no priest could convey a grace which he himself had not, and a "holy" church must consist only of holy members. This puritan party demanded of all who would enter their fellowship that they should submit to baptism, whether they had previously received that rite or not, although to administer baptism a second time was not the practice of the Church at large.

There was also another cause at work to produce the Donatist schism, viz., the jealousy of Carthage felt by the Numidian clergy, under the lead of their primate, Secundus, Bishop of Tigris. In 311, after the death of Mensurius, Bishop of Carthage, Cæcilian was chosen as his successor. The strict party and the "confessors" opposed Cæcilian on the ground of his laxity in discipline. They also charged that a traitor had taken part in his ordination, which was thereby invalidated. The Numidian clergy, already jealous of Carthage and displeased at not having been invited to participate in Cæcilian's election, took sides with this opposition, and these combined forces proceeded to elect a rival bishop of Carthage in the person of Majorinus. On his death, two years later (313), they elected the man from whom their party name is taken, Donatus, called the Great. Thus the North African church was divided into two hostile camps.

At Constantine's command synods were held to settle the dispute (Carthage, 311; Rome, 313; Arles, 314), and each time the Donatists lost their case. But their hold upon North Africa continued strong, and at the close of the century they were more numerous there than the Catholics. Signs of internal weakness, however, were not wanting. The Donatists had been reinforced by various malcontents, especially by the fanatical Circumcelliones (q.v.), ascetics of poor morals and worse manners, and this kind of support tended to encourage outbreaks of violence. Rogatus and a few followers withdrew about 370, and the serious defection of the Maximianists came in 393. All this weakened the movement and helped prepare the way for its final collapse. The chief instrument in bringing it to an end was St. Augustine of Hippo.

Augustine worked out and applied the Catholic position, which had already been pretty clearly formulated. Against the Donatists he taught that the Church on earth is a *corpus perfectum*; the wheat and the tares must grow together until the harvest. The "holiness" of the Church consists in its possession of sacerdotal power, by which it can transmit divine grace to needy men, not in the actual holiness of all its members. At first Augustine sought to win back the schismatics by means of argument. But he later came to believe in the application of force. Accordingly he approved the Imperial policy of coercion, adopted by Honorius in 405. See AUGUSTINE, SAINT.

In 411 a synod was held in Carthage, at which the whole subject of Donatism was debated anew, 286 Catholic bishops opposing 279 Donatists. The verdict (prearranged) was on the side of

Catholicism. The Donatists were deprived of civil rights, and a little later they were debarred from holding religious meetings upon pain of death. From this time Donatism rapidly lost its power. Although adherents of the sect are to be found for two centuries longer, their number and their public influence steadily decreases. The Saracen invasion of the seventh century put an end to the power of Donatism and Catholicism alike in North Africa.

Consult: Augustine, anti-Donatist writings, in vol. iv of *The Nicene Fathers* (1st series, ed. by Schaff, Buffalo, 1886); also his 93d *Epistle*; Optatus of Mileve, *De Schismate Donatistarum* (ed. by Ziwa in *Corp. Script. Eccles. Lat.*, xxvi, Vienna, 1893); Völter, *Der Ursprung des Donatismus* (Freiburg, 1883); Harnack, *History of Dogma* (Eng. trans., Boston, 1894-1900); Simpson, *St. Augustine and African Church Divisions* (New York, 1910).

**DONATO DI BETTO BARDI**, dō-nā'tō dē bēt'tō bār'dē. See DONATELLO.

**DONATUS.** See DONATISTS.

**DONATUS, AELIUS.** A well-known grammarian and commentator, who taught grammar and rhetoric at Rome about 335 A.D. and was the instructor of St. Jerome. He wrote treatises, *De Litteris, Syllabis, Pedibus et Tonis*; *De Octo Partibus Orationis*; *De Barbarismo et Solæcismo*, etc., which form together a pretty complete course of Latin grammar and in the Middle Ages were the only textbooks used in the schools, so that *Donat* came, in the west of Europe, to be synonymous with grammar or with the elements of any science. *The Donat into Religion* is the title of a book by an English bishop, and there was an old French proverb, *Les diables estoient encore à leur Donat* ('The devils were still in their grammar'). The Latin grammar of Donatus has formed the groundwork of the elementary treatises on that subject to the present day. His was one of the first books in which the art of printing by means of letters cut on wooden blocks was tried, and copies of these Donatuses are reckoned among the greatest of bibliographical curiosities. The best edition of Donatus is in vol. iv of Keil's *Grammatici Latini* (Leipzig, 1864). The author also wrote a commentary on Terence, of which we possess only a part, covering five comedies, to be found in the edition of Terence by Klotz (2 vols., Leipzig, 1838) and, better still, in the edition of Wessner (3 vols., Leipzig, 1902-08); and an important commentary on the *Æneid* and *Georgics* of Vergil, which exists to-day only in numerous quotations, preserved by Servius (q.v.). For the commentary on Terence, consult Karsten, *De Commentationis Donati ad Terenti Fabulas Origine et Compositione* (Leyden, 1907).

From this Donatus we must distinguish a later grammarian, TIBERIUS CLAUDIUS DONATUS, also of the fourth century A.D., author of a voluminous commentary, of little importance, on the *Æneid*. This is edited by Georgii (2 vols., Leipzig, 1905-06).

**DONAÜWÖRTH**, dō'nou-vērt' (Ger., neck of land on the Danube). A town of Bavaria, at the confluence of the Würnitz and the Danube, about 25 miles north-northwest of Augsburg (Map: Germany, D 4). It is built in the form of an amphitheatre around the side of a hill and has the most important monthly live-stock market in Bavaria. The chief industries are saw-milling, brewing, and making machinery. Do-

nauwörth is a river port and agricultural centre. It became a free imperial city in the fourteenth century. It was taken by Bavaria in 1607, as punishment for interference with Catholics by the Protestants, and this was one of the episodes that led up to the Thirty Years' War. Here Marlborough gained a victory over the Bavarians in 1704, and the French over the Austrians in 1805. Pop., 1890, 3733; 1900, 4400; 1910, 5500. Consult Königsdörfer, *Geschichte des Klosters zum Heiligenkreuz in Donaüwörth* (Donaüwörth, 1829), and Stieve, *Der Ursprung des dreizehnhundertjährigen Krieges*, vol. i, *Der Kampf um Donaüwörth* (Munich, 1875).

**DONAWITZ**, dō'nā-vīts. A town of Styria, Austria, 2 miles north of Leoben. Its iron and smelting works and rolling mills are important, and there are about 2000 men. There are also prospecting mines. The old pilgrims' church of Freienstein occupies an adjacent eminence. Pop., 1900, 13,093.

**DON BENITO**, dōn bā-nē'tō. A town in the Province of Badajoz, Spain, 57 miles east by north of the city of Badajoz, near the left bank of the Guadiana, on the Ciudad-Real-Badajoz Railway (Map: Spain, C 3). It is picturesquely situated and generally well built and possesses a fine square, the Plaza de la Constitución, with a central promenade. The town is the centre of a district noted for its melons and which produces also grain, wine, oil, and vegetables. It has manufactures of textiles, liquids, flour, and soap. Don Benito is a comparatively modern town, having been founded in 1477. Pop., 1900, 16,656; 1910, 19,212.

**DON CARLOS.** The title of several dramas and operas based on the life of the son of Philip II of Spain. 1. A tragedy by Otway, performed in 1676, called by Gosse the best English tragedy in rhyme. Its plot was borrowed from the historical romance by the Abbé de Saint-Réal. 2. A drama by Schiller, completed in 1787. 3. An opera by Verdi, produced in Paris, March 11, 1867.

**DON CARLOS.** See CARLOS.

**DONCASTER**, dōn'kas-tēr (*Don* + *caster*, AS. *ceaster*, from Lat. *castrum*, camp). A municipal borough and market town in the West Riding of Yorkshire, England, on the right bank of the Don, 32 miles south of York (Map: England, E 3). The country around is flat, but beautiful. Fine old elms line the broad and level road from the south. Doncaster is very clean and well built and contains a handsome church of St. George (a cruciform edifice in the Decorated style), built by Sir G. G. Scott in 1858; a fine market hall; a guildhall and corn exchange. The municipality owns its gas, water, and electricity supplies, as well as the tramways, and the race course and accompanying paddocks, where blooded stock is sold, all of which constitute an important source of revenue. Markets, slaughterhouses, a public library, and an art school are also maintained by the town. It has manufactures of iron, brass, sackings, linen, and agricultural machines. The principal locomotive and car works of the Great Northern Railway are situated here. Its corn market is one of the largest in the kingdom. Pop., 1901, 28,932; 1911, 30,520. It has long been famous for its annual races, begun as early as 1615, and held in the second week of September. On an eminence 7 miles south are the ruins of Conisborough Castle (of Scott's *Ivanhoe*), a Norman-

Saxon round tower, 37 feet in diameter and 86 feet high, with walls 15 feet thick, strengthened by square buttresses. The door is reached by an external flight of 37 steps. Doncaster was the Danum of the Romans and the Dona Ceaster of the Saxons and suffered severely during the Danish invasion. It received municipal rights towards the end of the twelfth century.

**DONCELLA**, or **DONZELLA**, dôn-să'lyă or dôn-zê'lă (Sp., It., girl). The name in the West Indies of several small, gaudy, and graceful fishes, as the snakelike carnivorous Ophidiidæ, of which one species (*Ophidion marginatum*), also called sand cusk, extends northward to New York; or of the labroid fishes of the genus *Platy-glossus*, especially *Platy-glossus radiatus*, also called bluefish and pudding wife.

**DON CÉSAR DE BAZAN**, dôn sâ'zăr' de bâ'zăn'. The title of a French comedy by Duma-noir and Dennery (1844), suggested by the humorous underplot in Hugo's *Ruy Blas*. The hero is also the subject of a comic opera by Massenet (1872).

**DON COSSACKS**, PROVINCE (OR TERRITORY) OF THE. A region in southern Russia, bounded by the governments of Voronezh and Saratov on the north, Saratov and Astrakhan on the east, Stavropol and Kuban on the south, the Sea of Azov and the governments of Ekaterinoslav, Kharkov, and Voronezh on the west (Map: Russia, F 5). Its area is about 63,532 square miles. The surface is generally level, the portion lying west of the Don being slightly elevated. The whole territory belongs to the basin of the Don. The soil is for a large part fertile. The Don, navigable throughout the province, is connected by a railway, 45 miles long, with the Volga. Large quantities of heavy freight move by these two streams, and considerable quantities are interchanged by rail.

Agriculture is the leading industry. Rye, wheat, oats, and barley are the chief cereals grown. The cultivation of the vine is carried on extensively, the output of wine being exported all over Russia. The raising of live stock is also an important industry, and fishing, especially for herring, gives occupation to a considerable portion of the inhabitants. The territory has some of the richest coal deposits in Russia, known as the Donetz Coal Basin. Coal has been mined in the territory since the end of the eighteenth century, and the present annual output exceeds 12,500,000 tons. Iron, lead, gypsum, and salt are also mined. The manufacturing industry is but slightly developed. Tobacco and cigarette factories, flour mills, potteries, and iron works are practically the only establishments. The government is administered by the Ministry of War and is divided for administrative purposes into nine districts. The capital is Novo-Tcherkask; the chief commercial centre is Rostov. The population was estimated in 1912 at 3,591,900, of whom Cossacks (q.v.) and other Russians composed nearly 98 per cent. Latest official estimates put the number of Kal-muck Tatars at approximately 30,000, Armenians 27,000, and Jews 16,000.

**DON'DERBERG**, or **DUNDERBERG** (Dutch; Thunder-Mount). The name of a mountain on the Hudson River, a short distance below West Point, the subject of a local legend.

**DON'DERS**, FRANZ CORNELIUS (1818-89). A Dutch physiologist and ophthalmologist, born at Tilburg, North Brabant. He was educated at the University of Utrecht, in 1842 was appointed

lecturer, and in 1847 professor at that institution. He established a modern physiological laboratory at the university and erected the *Nederlandsch Gasthuis voor Ooglijders*. His researches were chiefly devoted to the physiology of optics and were considered very valuable. The introduction of prismatic and cylindrical glasses is due to him. Among his principal publications may be mentioned: *Anomalies of Accommodation and Refraction of the Eye*, a subject to which he gave especial attention (published in English by the Sydenham Society); *Die Lehre von den Augenbewegungen* (in German, 1847); the so-called Law of Donders, *De leer der stofwisseling als bron der eigenwarme* (1845); *De harmonie van het dierlijk leven* (1847). Consult Moleschutt, *Franciscus Cornelius Donders* (Giessen, 1888).

**DONDO**, dôn'dô. A town in the Portuguese colony of Angola, West Africa, on the Coanza River (Map: Congo, B 4). The town is important on account of its caravan trade and its proximity to the Loanda Railway. The surrounding country is fertile, but this entire portion of the Coanza River basin is known as the "furnace," or "hell," of Angola. Dondo is also the centre of the coffee trade. It is connected by steamers with Loanda. Pop. about 3000.

**DONDÚKOV-KORSSÁKOV**, dôn'du-kôv' kôr-sâ'kôv', ALEXANDER MICHAILOVITCH, PRINCE (1820-93). A Russian statesman. After receiving a good education at St. Petersburg University, he entered the military service, participating in many important campaigns with considerable distinction. He quickly attained the rank of general in the Russian army and in 1878 was appointed Governor of Bulgaria. After the conclusion of the arrangement effected by the Berlin Congress, he remained in Russia, whose first Parliament he opened at Tirnova in 1879. He was chosen Prince of Bulgaria, but was instructed by the Czar to refuse the dignity and to secure the election of Prince Alexander of Battenberg. From 1882 to 1890 he was commander in chief of the Russian forces in Caucasasia and administrator of the civil government in that region.

**DONEAU**, dô'nô', HUGUES, Latin name DONELLUS (1527-91). A French jurist. He was born at Chalons-sur-Saône and was educated at Toulouse and Bourges. After having been for 20 years professor of Roman law at Bourges, he was compelled to flee to Geneva at the time of the massacre of St. Bartholomew's Day and subsequently became professor at Heidelberg (1573), Leyden (1579), and Altdorf (1588). The civil jurisprudence of modern times has availed itself of his systematic methods. His celebrated *Commentarii de Jure Civili* (16 vols., 6th ed., 1822-34) is a faithful compilation of the civil law and legal procedure of Rome.

**DONEGAL**, dôn'ê-găl' (Ir. *Dun-na-n Gal*, Fort of the Stranger, in allusion to the Danish invaders). A maritime county of Ireland, in Ulster Province, bounded north and west by the Atlantic (Map: Ireland, C 2). It is the largest county in Ireland and has an area of 1870 square miles, and an extensive and much indented coast line, off which lie numerous islands. The surface is, for the most part, mountainous, moory, or boggy, interspersed with many small lakes and rivers. About 35 per cent of the land is pasture. The inhabitants are mainly engaged in agriculture, in which little progress has been made. Linen and

woolen manufactures are carried on, and the female population is largely engaged in the working of muslin. Many of the inhabitants on the coast are occupied in the fisheries, and the inland salmon fisheries are also important. Capital, Lifford. The population since 1841 shows a continual decrease (though less so than in other counties), having been at that date 296,500; 1851, 255,200; 1891, 185,635; 1901, 172,722; 1911, 168,537.

**DONEGAL.** A seaport in the south of Donegal County, Ireland, at the mouth of the Eske, on a shallow creek of Donegal Bay, 11 miles north-northeast of Ballyshannon (Map: Ireland, C 2). It lies in a rich alluvial tract, surrounded on three sides by hills, behind which rise lofty, picturesque mountains. Near the town are Donegal Castle, formerly belonging to the O'Donnells of Tyrconnell, and the ruins of a Franciscan monastery, founded in 1474 by the first wife of Hugh Roe, completed by his second wife, and richly endowed by the O'Donnell family, some of whom spent their last years in its cloisters. Here was written the collection of early Irish chronicles known as the *Annals of the Four Masters*, a record of Irish history to 1616, finished in 1636 by Michael O'Cleary, a Franciscan scholar, and his associates. Pop., 1901, 1214; 1911, 2647.

**DONELUS.** See DONEAU, HUGUES.

**DON'ELSON, ANDREW JACKSON** (1800-71). An American politician and diplomat. He was born near Nashville, Tenn., and was educated at Nashville College and at West Point Military Academy. Commissioned a lieutenant of engineers, he accompanied, in 1820, his uncle, Gen. Andrew Jackson, as his aid-de-camp, to Florida. In 1822 he resigned from the army, and after a year's study of law at Transylvania University at Lexington, Ky., he was admitted to the bar. He actively participated in the campaigns of Jackson for the presidency in 1824 and 1828 and after the latter's inauguration in 1829 became his private secretary at Washington, continuing to act in that capacity through his two administrations. While charged with the Republic of Texas (1844-45) by appointment of President Tyler, he arranged a new treaty of annexation, the first having been rejected by the Senate. His mission terminated successfully with the admission of Texas to the Union in 1845. In 1846 he was appointed by President Polk Minister Plenipotentiary to Prussia and in 1848 was accredited to the federal government of Germany. Returning to the United States towards the close of 1849, he took an active part in the discussion of the Mexican War. He attended the Southern Convention at Nashville in May, 1850, where he was one of the ablest and most earnest champions of the Union. He was a strong supporter of Clay in the Compromise of 1850 and in the year following became editor of the *Washington Union*, an organ of the Democratic branch of the Democratic party, as he did. In 1853, however, he became entirely alienated from the Democratic party, and in 1856, when ex-President Millard Fillmore was nominated for President by the American party, Donelson was made the nominee for Vice President. After his defeat he retired to private life and, although always a strong Union man, took no part in the events preceding the Civil War, throughout which he lived quietly on his estates

in Tennessee. After the war he practiced law in Memphis, Tenn.

**DON'ELSON, FORT.** See FORT HENRY AND FORT DONELSON.

**DONETZ, dö-nyët's'.** A tributary of the Don rising in the Russian government of Kursk (Map: Russia, E 5). It flows through the Province of the Don Cossacks and joins the Don at Konstantinovskaya. Its total length is over 670 miles, and it is navigable during high water to Izum, in the Government of Kharkov. Its banks are thickly wooded, and there are coal deposits in its basin from which a considerable quantity of coal is mined.

**DON'GAN, THOMAS, EARL OF LIMERICK** (1634-1715). A Colonial governor of New York. He was born at Castletown, County Kildare, Ireland. He served in the English and French armies with the rank of colonel and in 1678 was appointed Lieutenant Governor of Tangier by Charles II. The Duke of York appointed him Governor of the Province of New York in 1682. Being a Roman Catholic he was at first looked upon with suspicion by the colonists, but he showed himself champion of their interests and managed the relations between the English, French, and Indians with great sagacity. He granted a charter to the city of New York, and another to the city of Albany, which still remains the basis of its municipal rights. In 1688, as a result of the scheme of confederation of the Northern Colonies furthered by James II, he was obliged to resign his governorship to Sir Edmund Andros whom the English King had named as the head of the government of New England and New York. He remained in America, however, until 1691, although he had to undergo some persecution at the hands of the government which had succeeded Andros as a result of the revolution of 1688. He succeeded to the title of Earl of Limerick by the death of his brother in 1698.

**DON GIOVANNI, dön jö-vän'né.** The title of an opera by Mozart, produced with unexampled success at Prague in 1787. It is the composer's masterpiece. See DON JUAN.

**DONGOLA, dön'gô-lâ.** A province of Anglo-Egyptian Sudan, situated between lat. 18° 30' and 19° 40' N. and lying entirely within the region known as Nubia. It is a level and fertile and produces large quantities of wheat and dates for export. Its inhabitants about 50,000 in number, are a mixed race of Turkish, Arabic, and Mameluke descent and profess Islamism. Dongola, formerly a prominent province, was taken in 1812 by the Mamelukes, who had been expelled from Egypt but they were soon compelled to abandon their new place of refuge after the expedition of Ibrahim Pasha in 1821. During the Mahdist revolt the province fell into the hands of the dervishes, from whom it was regained by the Anglo-Egyptian forces under Kitchener in 1896. The present capital of the province is El-Ordeh (q.v.), or New Dongola, on the west bank of the Nile. Old Dongola, situated on the east bank of the Nile, about 75 miles above El-Ordeh, which was an important place and capital of Dongola in antiquity, is now a mere village. The province has now railway connection with Egypt, Khartum, and the Red Sea by a short line opened in 1906 from Kareima to Abu Hamed, on a railway line connecting the cities above named.



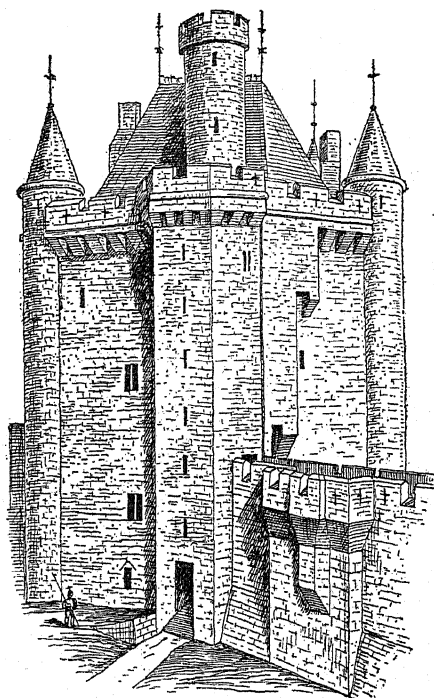
**DONGOLA** (from *Dongola* in Egyptian Sudan) **KID**. Sheepskin or goatskin tanned with a semibright finish and so finished as to resemble French kid. It was first put on the market in 1880 by James Kent, of Gloversville, N. Y., and created a revolution in certain branches of the leather industry.

**DONIOL**, dō'nyōl' (JEAN) HENRI (ANTOINE) (1818-1906). A French publicist and historian, born at Riom (Puy-de-Dôme). He studied at the University of Paris and in 1848-50 and 1871-72 was a member of the departmental administration. In 1882-95 he was director of the national printing establishment. His publications include the following scholarly works: *Histoire des classes rurales en France* (1857), partly revised in 1900 as *Serfs et vils au moyen âge*; *La révolution française et la féodalité* (1874); *Histoire de la participation de la France à l'établissement des États-Unis d'Amérique* (5 vols. and sup., 1886-1900), a valuable and monumental work, in which numerous important documents were first placed before the public, and for which he is best known, especially in America; *De 1815 à 1900* (1903); *La Fayette dans la révolution* (1904); *Thiers* (1905). Consult the "Notice" by Voisin in *Séances et travaux de l'Académie des Sciences morales et politiques* (1909).

**DONIS CONDITIONALIBUS**, dō'nīs kōn-dīsh'i-ō-nāl'i-būs, **STATUTE DE** (Lat., concerning conditional gifts). The usual legal title of the famous Statute of Westminster II (13 Edw. I, c. 1), passed in 1285, which created and stereotyped the form of estate which is known as a fee tail. Prior to its enactment such estates were known as conditional fees or gifts, whence the name of the statute. Thus, a gift of lands to a man and the heirs of his body was construed to be a fee simple, descendible to his heirs in general, in case he complied with the condition that he have lawful issue. He could then, by alienating the lands to a stranger in fee simple, defeat the expectations of his issue, just as a man may now, by alienation of an estate of inheritance, defeat the expectations of his heirs. By the same act the right or expectation of any remainderman to whom the estate was to go on failure of issue was also cut off. This disposition of the conditional fee contrary to the expressed intention of the one who created it (known as the *donor*) was regarded by the great landowners as a grave abuse, and it was to remedy this that the Statute *de donis* was passed. It provided that for the future the will of the donor of conditional gifts should be observed "so that they to whom the land was given under such condition shall have no power to aliene the land so given, but that it shall remain unto the issue of them to whom it was given after their death, or shall revert unto the giver or his heirs if issue fail," etc. This limitation upon the power of the donor of a conditional gift had the practical effect of restricting the descent thereof to the heirs of his body, and so created the fee-tail estate as it has come down to us. For the permanent effects of the statute, see **FEE TAIL**; **ESTATE**.

**DONJON** (OF. *donjon*, *dongon*, *dongeon*, Fr. *donjon*, Prov. *donjon*, *dompnhon*, from ML. *dominio*, *dungeon*, from *dominio*, Lat. *dominium*, lordship, from *dominus*, lord), or **DUNGEON**. The principal tower or keep of a castle or fortress. It was so called because from its

position it dominated or commanded the other parts of the fortress. From the circumstance that the lower or underground story of the donjon was used as a prison has come the modern meaning of the word. See **CASTLE**; **KEEP**.



A DONJON.

**DONIZETTI**, dō'nē-dzēt'tē, GAETANO (1797-1848). An Italian operatic composer, born at Bergamo, Nov. 29, 1797. He studied at the local conservatory under Simon Mayr, Salari, and Gonzalez, and later at Bologna. In 1819 his first opera, *Enrico di Borgogna*, won success at Venice, and he thereafter wrote about three operas a year. He mastered so perfectly the style of Rossini, then reigning supreme, as to rival the "Swan of Pesaro" himself. Then Bellini appeared and threatened to eclipse him. Donizetti took particular pains with his *Anna Bolena* (1830), which was presented at Milan on the same night as Bellini's *Sonnambula*. This marked the beginning of more serious work on his part. *L'Elisir d'Amore* (1832), a comic opera, and the tragic *Lucrezia Borgia* (1834) and *Lucia di Lammermoor* (1835) were his next particular successes. Upon the death of Bellini he remained the undisputed master of the Italian stage and was eagerly acclaimed all over Europe. He settled in Paris (1835) and began to write for the French stage. *La fille du régiment* (1840) had enormous success at the Opéra Comique; *Les martyrs* (forbidden by the censor in Italy as *Polyuto*) and *La favorita* were both given in Paris the same year, and *Don Pasquale*, a comic opera, in 1843. In 1842 *Linda di Chamounix* created a furore in Vienna, and the Emperor showered honors upon him. Amid this unexampled series of successes and honors his mind gave way, and the last four years of his life he was insane. A great festival was held in Donizetti's honor



at Bergamo on the one hundredth anniversary of his birth, and a monument was erected there in 1855. The facility of his pen was astounding; the fourth act of *La favorita* was composed in a tavern while he was waiting for a friend, and both music and libretto of *Il Campanello di Notte* were written within nine days. With this facility he combined an endless flow of melody and a genuine dramatic talent, but his workmanship was superficial and careless. In his comic operas, as, e.g., *Don Pasquale*, *La fille du régiment*, he exhibits an excellent comic vein, and the music is light and sparkling. In all he wrote about 70 operas. Consult F. Cicconetti, *Vita di G. Donizetti* (Rome, 1864), and Ferris, *Great Musical Composers* (New York, 1887).

**DON JUAN**, *Sp. pron.* dōn hwān (*Sp.*, Sir John). A legendary figure, and one of the most widely handled in all modern poetry. The ideal of the Don Juan legend is presented in the life of a profligate who gives himself up so entirely to the gratification of sense that he acknowledges no higher consideration, and proceeds to murder the man who stands between him and his wish, fancying that in so doing he has annihilated his very existence. Partly in wanton daring, partly to allay all uneasy misgiving, he then challenges that spirit in which he disbelieves to demonstrate to him its existence in the only way he holds valid, viz., through the senses. When this actually happens, when the spirit proves its existence and power, and compels him to acknowledge its supremacy and the worthlessness of a merely sensual existence, he is crushed and sinks into hell. Although the germinal idea of the Don Juan legend appears in Juan de la Cueva's *El Infamador* (1581), the legend did not assume definite form, nor did the hero become typical, until both had been treated by the master hand of Gabriel Téllez (Tirso de Molina), in *El Burlador de Sevilla y Convidado de Piedra*. In it the hero is described as a member of a celebrated Sevillian family, Tenorio, while the action of the piece turns mainly upon his betrayal of his friend, the Marqués de la Mota, and his attempt to seduce the latter's betrothed. Being opposed by her father, he kills him, forces his way into the family tomb of the murdered man, causes a feast to be prepared, and invites the statue which has been erected over his victim to be his guest. The stone guest appears at table as invited, compels Don Juan to follow him, and, the measure of his sins being full, delivers him over to hell. This drama was worked over in Italy by Ciconini and by Giliberto, not later than 1650. It became the basis of Dorimond's *Festin de pierre* (1658), of *Le festin de pierre, ou Le fils criminel*, of De Villiers (1660), of the *Don Juan* of Molière (1665), and of still other versions by Rosimond and Thomas Corneille. In England it was utilized by Sir Aston Cokain in the *Tragedy of Ovid* (1669) and by Shadwell in *The Libertine* (1676). Tirso's play was recast, to its detriment, in the early years of the eighteenth century by Antonio de Zamora, and Goldoni used the versions of Molière and Thomas Corneille as the foundation of his *Don Giovanni Tenorio ossia Il Dissoluto*. In the seventeenth century it served repeatedly in Italy as a theme for opera, being first used by Gluck, and later handled successively by Righini, Cimarosa, Albertini, Gazzaniga, and other composers. All of these were eclipsed by Mozart's immortal

work, *Don Giovanni*. Among modern uses of the theme are: Prosper Mérimée, *Les âmes du purgatoire*; Dumas's drama, *Don Juan de Marana*; Byron, D'Aureville, Balzac, and Flaubert's posthumous fragment; also Bernard Shaw's fantastic episode in *Man and Superman*. But the most stirring and effective modern treatment of the legend was produced in its native land by José Zorilla, whose *Don Juan Tenorio: drama fantástico-religioso*, in two parts, overshadows all others and has become so popular that it is staged annually in practically every theatre in Spain for two weeks at the festivals of All Saints and All Souls (November 1 and 2). Consult: Picatoste, *Don Juan Tenorio* (Madrid, 1883); Engel, *Die Don Juan-Sage* (Dresden, 1887); A. Farinelli, *Don Giovanni, note critica* (Torino-Roma, 1896); Gendarme de Bévotte, *La Légende de Don Juan* (Paris, 1906) and *Le Festin de Pierre avant Molière* (ib., 1907); S. M. Waxman, "The Don Juan Legend in Literature," in *Journal of American Folk-Lore*, vol. xxi (New York, 1908); Victor Said Armesto, *La leyenda de Don Juan* (Madrid, 1908); Theodor Schröder, *Die dramatischen Bearbeitungen der Don Juan-Saga in Spanien, Italien und Frankreich, bis auf Molière einschliesslich* (Halle, 1912). Schröder's work contains an excellent bibliography.

**DONKEY** (from *dun*, with reference to its color + double diminutive *key*). The domestic ass. See ASS, and Colored Plate of HORSES.

**DONNAI**. See DONAI.

**DONNAY**, dō'nā', MAURICE CHARLES (1859- ). A French dramatist, born in Paris. He made his first appearance on the stage in 1891 with *Phryné*, a Greek shadow play, followed in 1892 by an adaptation of the *Lysistrata* of Aristophanes. All his early work embodies the essence of Parisian *esprit*, but his later work is more serious in tone. His best-known plays are: *Amants* (1895); *Douloureuse* (1897); *L'Affranchie* (1898); *Le torrent* (1898); *La bascule* (1901); *L'autre danger* (1901); *Le retour de Jérusalem* (1903), in which he caricatures Max Nordau; *La Patronne*; *Paraitre*. *Ménage de Molière* was produced in 1912. He was elected to the Academy in 1907.

**DONNDORF**, dōn'dōrf, KARL ADOLF (1835- ). A German sculptor, born at Weimar. He studied under Rietschel in Dresden, and upon the latter's death he aided in completing the Luther Monument at Worms, after Rietschel's designs. The statues of Savonarola, Frederick the Wise, "Valdies," and "Mourning Magdeburg" are by Donndorf. His first important independent work was the equestrian statue of Grand Duke Karl August in the Fürstenplatz, Weimar (1872). Among his works are the tombs of Robert Schumann in Bonn and the Kestner Family in Dresden; the statues of Peter Cornelius in Düsseldorf and of Bach in Eisenach; the "Angel of the Resurrection" at Castle Reineck; the James Fountain in New York City; and the busts of Bismarck and Moltke in the National Gallery, Berlin—said to be their most characteristic likenesses. His more recent achievements are the equestrian statues of William I at Saarbrück (1904) and at Heidelberg (1905), and the National Monument at Hohensyburg, Westphalia. His work is poetic and intellectual in conception, naturalistic and forceful in treatment. He was appointed professor at Stuttgart

in 1876, and in 1910 a Donndorf Museum was opened at Weimar.

**DONNE**, dŏn, JOHN (1573-1631). An English poet and divine. He was born in London, where his father, John Donne, who was Welsh by descent, was a prosperous ironmonger. His mother was a daughter of John Heywood the epigrammatist. He was brought up a Roman Catholic. In 1584 he was admitted at Hart Hall, Oxford, but was transferred to Cambridge, and in 1592 he was entered at Lincoln's Inn. A little later he turned Protestant. In 1596 he served under Essex in the famous expedition to Cadiz, and on his return was appointed secretary to Sir Thomas Egerton, Keeper of the Great Seal. During the next few years he wrote many poems, some of which circulated in manuscripts, but none were published. In December, 1600, he secretly married Anne, then only 17 years old, the daughter of Sir George More, brother of the Lord Keeper's wife. In consequence of this act he was dismissed from office and was even committed to the Fleet, but he soon obtained his release. Though James was friendly towards him, the King gave him no post at court. Donne continued to write verse, sending the manuscripts of his *Divine Poems* to the mother of George Herbert in 1607. In 1610 he wrote for the King the *Pseudo-Martyr*, an argument against the attitude of the Catholics towards the oath of allegiance. This was his first publication. The next year he published a beautiful elegy on the death of Elizabeth, daughter of Sir Robert Drury, who was Donne's patron. This poem was followed in 1612 by a philosophical poem, called *The Progress of the Soul*. Donne soon began to look towards the Church for a career. In 1615 he was ordained in London, and the University of Cambridge made him a D.D. The next year he was presented to the livings of Keyston in Huntingdonshire and of Sevenoaks in Kent. He never resided in either parish, but he held Sevenoaks till his death. The same year he was appointed divinity reader at Lincoln's Inn, and in 1621 he was elected dean of St. Paul's. He died March 31, 1631, and was buried in St. Paul's. As a preacher, Donne at once attained eminence. His verse consists of satires, elegies, religious poems, epistles, and epigrams. Donne was among the first of a series of poets of the seventeenth century who, under the infelicitous name of "the metaphysical poets," fill a conspicuous place in English literary history. The directness of thought, the naturalness of description, the rich abundance of genuine poetical feeling and imagery, now began to give way to cold and forced conceits, and elaborate exercises of the intellect. Yet it is generally acknowledged, even in the case of Donne, that amid all this there is real poetry, and that of a high order. Especially beautiful are *The Storm*, *The Calm*, *The Blossom*, *The Primrose*, and *Upon Parting with his Mistress*. Donne's influence has been very great, for not only did he found a school of poetry which flourished till the advent of Dryden, but his intensity and obscurity passed into Browning. Donne published little, but from his voluminous manuscripts a collection of the poems was published in 1633; and 80 sermons in 1640, to which was prefixed a charming Life by Isaak Walton. For his poems, consult the editions by Grosart, in *Fuller's Worthies Library* (London, 1872); and by Chambers, with introduc-

tion by Saintsbury (ib., 1896); for sermons: Alford, *The Works of John Donne* (ib., 1839); for his life: Jessop (ib., 1897), and Gosse, *Life and Letters of John Donne* (ib., 1899); Donne's *Letters to Several Persons of Honour* (New York, 1910), edited and annotated by C. E. Merrill, Jr., throws new light on the poet. In 1912 (Oxford) appeared *Poems; With Introductions and Commentary*, edited by H. J. C. Grierson (2 vols. Vol. i contains text and appendixes; vol. ii, introduction and commentary).

**DONNE CURIOSE**, dŏn'nâ kŭr'è-sâ, LE. An opera by Wolf-Ferrari (q.v.), first produced at Munich, Nov. 27, 1903; in the United States, Jan. 3, 1912 (New York).

**DON'NELLY**, IGNATIUS (1831-1901). An American journalist, politician, and essayist of eccentric ingenuity. He was born in Philadelphia, studied law there, and was admitted to the bar in 1852, went to Minnesota in 1856, and was elected Lieutenant Governor of that State in 1859 and 1861. From 1863 to 1869 he was a representative in Congress. In 1873-78 he edited at St. Louis the *Antimonopolist*, a weekly newspaper in support of the Greenback policy, and in 1876 was president of the Antimonopoly Convention that nominated Peter Cooper for the presidency of the United States. For many years he served as a Democrat in both houses of the Legislature of Minnesota. He was nominated for the vice presidency of the United States in 1898 by the People's party and in 1900 by the "Middle-of-the-Road" wing of that party. Latterly he edited at Minneapolis a journal called the *Representative*. His *Atlantis* (1882; 8th ed., 1910) endeavored to prove that the island of that name once really existed and was the original seat of civilization. *Ragnarök* (1883) undertook to explain the geologic formations of the drift age by cometary contact. *The Great Cryptogram* (1887) sought, by the application of an elaborate word cipher to the First Folio, to furnish convincing evidence of the Baconian authorship of Shakespeare. He also wrote *Cæsar's Column*, a novel (1890; 1906), and *Cipher in the Shakespeare Plays* (1900).

**DONNELLY**, SAMUEL BRATTON (1866- ). An American public printer and union labor leader, born at Concord, Pa. He was educated at the State Normal School, Shippensburg, Pa., taught until 1886 in the schools of Franklin County, and then entered the printing trade. He was president of the New York Typographical Union No. 6 (1895-98) and of the International Typographical Union, Indianapolis (1898-1900), and served as secretary of the National Civic Federation (1901-02) and of the Joint Arbitration Board of the New York Building Trades Employers' Association (1903-08). He served as commissioner of the New York Board of Education from 1901 until 1908, when he was appointed public printer at Washington.

**DON'NER**, JOHANN JAKOB CHRISTIAN (1799-1875). A German translator of the classic poets. He was born at Krefeld and, after studying at Tübingen, was professor at Stuttgart from 1843 to 1852, when he resigned his professorship to devote himself entirely to literary labors. He rendered the works of the Greek and Roman poets into German in their original metres. Among his translations are those of the satires of Juvenal (1821), Persius

(1822), and the tragedies of Sophocles (1838-39; 11th ed., 1889). This work, his masterpiece, is still the basis for almost all the metrical translations of Sophocles. It was followed by translations of Euripides (1841-53), Aeschylus (1854), the *Iliad* (1855-57), the *Odyssey* (1858-59), Pindar (1860), and Aristophanes (1861). His translations of Terence (1864), Plautus (1864-65), and Quintus Smyrnaeus (1866), were less successful.

**DONNER, RAPHAEL** (1693-1741). An Austrian sculptor. He was born at Esslingen and studied under Giuliani in Vienna and later visited Italy. In 1725 he furnished statues for the Archbishop's palace in Salzburg, and in 1728 was appointed chief architect to the Hungarian Primate in Pressburg, where the decoration of the Eleemosynary Chapel in the cathedral is the only work of his which has survived. His masterpiece is the fountain in the Neu Markt at Vienna, the original of which was replaced by bronze copies in 1873. Other fine works are a lead relief for a fountain in the court of the Old Town Hall, Vienna, and a group of the "Crucifixion" in Gurk Cathedral. He was the most important representative of baroque sculpture in Austria, and substituted for the overelaborate and confused style of Bernini, then dominant in plastic art, a simpler method, combining the rococo and the antique.

**DONNYBROOK** (Ir., church of St. Broc). Now a part of the city of Dublin, Ireland. It was formerly famous for its fair, instituted under King John in 1204 and held annually in August. Originally of two weeks' duration, in later times the fair lasted only a week. It became notorious for its attendant debauchery and fighting and in 1855 was finally abolished. Consult B. Gray (pen name of R. B. Coffin), *Donnybrook Fair* (New York, 1865).

**DONORA**, dô-nô'râ. A borough in Washington Co., Pa., 35 miles south of Pittsburgh, on the Pennsylvania and the Pittsburgh and Lake Erie railroads, and on the Monongahela River (Map: Pennsylvania, A 7). It is in a coal-mining and agricultural region and has manufactories of steel, wire, chemicals, fence, nails, and gas mantles. At Fells Church, 1 mile east of here, the Whisky Insurrectionists held several meetings in 1794. Donora was incorporated in 1900. Pop., 1910, 8174.

**DONOSO**, dô-nô'sô, Justo (1800-68). A Chilean bishop, jurisconsult, journalist, professor, and statesman, born at Santiago de Chile. He became rector of the Seminario Conciliar in that city and was subsequently appointed lecturer on theology and secretary of the theological faculty at the university, and judge of the ecclesiastical court. He was one of the founders of the *Revista Católica*, which was published for more than 30 years, and was distinguished for his versatility as a lecturer, author, and minister. He afterward became Bishop of Ancud (1844-55) and Serena (1855-68). His publication entitled *Instituciones de derecho canónico americano* (1849 and 1863) is regarded as a standard work. Of great importance, too, is his *Diccionario teológico, canónico, y litúrgico* (1855).

**DONOSO-CORTÉS**, dô-nô'sô kôr-tâs', JUAN FRANCISCO MARÍA DE LA SALUD, MARQUÉS DE VALDEGAMAS (1809-53). A Spanish author and diplomat, born at Valle de Serena (Estremadura). He was educated in the humanities at Salamanca and for the bar at Seville,

entered public life, and took the part of Isabella against Don Carlos in the revolution of 1832. He was Secretary of the Council under Mendizabal and followed the Queen mother in her flight to France (1840). When she returned, he was made Secretary (1844), had charge of the education of the young Queen, and was finally sent as Ambassador to Berlin (1848). About this time he astonished his countrymen by proclaiming the absolute supremacy of the Catholic church in his work, *Ensayo sobre el catolicismo, el liberalismo y el socialismo* (1851). He died while Ambassador to Paris, his last official post. His works were published, with a biography by Tejado (5 vols., Madrid, 1854-55).

**DON PASQUALE**, päs-kwä'lâ. A comic opera by Donizetti, first produced at Paris, Jan. 3, 1843; in the United States in 1849 (New York).

**DON QUICHOTTE**, dôn kê-shôt'. An opera by Massenet (q.v.), first produced at Monte Carlo, Feb. 19, 1910; in the United States, at New Orleans, Jan. 27, 1912.

**DON QUIXOTE**, dôn kwiks'ôt, *Sp. pron.* dôn kê-îŏ'tâ. See CERVANTES.

**DON SALTER'S COFFEEHOUSE**. An eating house and museum, established by John Salter, a barber, in 1695, in Cheyne Walk, Chelsea, London, and demolished in 1866. It is frequently mentioned by Swift, Steele, and other writers of that period.

**DON SANCHE D'ARAGON**, dôn sänsh dá-râ-gôn'. A comedy by Corneille, derived from a Spanish play, *El palacio confuso*, and produced in 1650.

**DONUS**, or **DOM'NUS** (?-678). Pope from 676 to 678. He was a patron of architecture and the arts, and made a rebellious archbishop of Ravenna acknowledge the claims of Rome. A Donus II is sometimes placed on the list of popes for the year 974. This is an error, the word *domnus* in the expression *domnus papa*, used as a shorter form of *dominus*, having been wrongly taken as a proper name.

**DONZELLA**. See DONCELLA.

**DOO**, GEORGE THOMAS (1800-86). An English engraver. He was born at Christchurch, Hants, and studied under Heath in London. His "Duke of York," after Sir Thomas Lawrence, engraved in 1824, was his first important work. In 1825 he went to Paris and studied under Suisse. Doo was appointed court engraver to William IV and also to Queen Victoria. In 1856 he was elected a fellow of the Royal Society and in 1857 an Academician. He devoted himself chiefly to old-style line engraving. Among the best known of his carefully executed plates are: "Nature," after Lawrence; "The Pan-hanger Madonna," after Raphael; "Ecce Homo," after Corrregio; "The Pilgrims in Sight of Rome," after Eastlake; "Knox Preaching," after Wilkie; and "The Raising of Lazarus," after Sebastiano del Piombo.

**D'OUGE**, dô'gê, BENJAMIN LEONARD (1860-). An American classicist, brother of Martin L. D'Ouge. He was born in Grand Rapids, Mich., graduated at the University of Michigan in 1881 and studied also at the University of Bonn; was principal of the Coldwater (Mich.) high school (1881-83), taught Latin at the University of Michigan (1884-85), and in 1886 became professor of ancient languages at the Michigan State Normal College. He was presi-

dent of the Michigan Schoolmasters' Club in 1903-04 and of the Classical Association of the Middle West and South in 1910-11. He edited: *Colloquia Latina* (1888); *Viri Romæ* (1895); *Easy Latin for Sight Reading* (1897); *Cæsar's Gallic War* (1898) and *Second Year Latin* (1899), with James B. Greenough and M. Grant Daniell; *Helps to the Study of Classical Mythology* (1899); *Cicero, Select Orations* (1901); *Latin Composition* (1901); *Latin Composition for Secondary Schools* (1904); *Latin for Beginners* (1909; 2d ed., 1911).

**D'OOGÉ**, dō'kē, MARTIN LUTHER (1839- ). An American classical scholar, born at Zonnenarie, Netherlands. He received the degrees of A.B., University of Michigan (1862); Ph.D., Leipzig (1873); LL.D., University of Michigan (1889), and was professor of Greek in the University of Michigan from 1870 to 1912. In 1878 he was ordained to the Congregational ministry. He was director of the American School of Classical Studies at Athens in 1886-87, and president of the American Philological Association in 1884. He was the editor of Demosthenes, *De Corona* (Chicago, 1888); Sophocles, *Antigone* (Boston, 1885); etc. He contributed also to various periodicals. In 1908 he published an elaborate work, *The Acropolis of Athens*.

**DOOLEY**, MR. See DUNNE, FINLEY PETER.

**DOOLITTLE**, CHARLES CAMP (1832-1903). An American soldier, born at Burlington, Vt. In 1862 he was appointed colonel of the Eighteenth Michigan Volunteers and subsequently served in the Peninsular campaign. He was in Kentucky in 1862-63 and Tennessee in 1863-64, was in command of Decatur, Ala., during the first day of the defense against Gen. J. B. Hood, led a brigade at Nashville, and in 1865 was placed in command of that city. For a time he was in 1865 a commander of the northeastern district of Louisiana. In that year he was brevetted major general.

**DOOLITTLE**, (CHARLES LEANDER (1843- ). An American astronomer, born in Ontario, Ind. He graduated from the University of Michigan in 1874, served for a year on the U. S. Boundary Survey, and held the chair of mathematics and astronomy at Lehigh University from 1875 to 1895, when he was appointed professor of astronomy at the University of Pennsylvania and director of the Flower Astronomical Observatory. He was treasurer of the Astronomical and Astrophysical Society of America from 1899 to 1905 and after 1909, a vice president of the American Association for the Advancement of Science in 1893, and a curator of the American Philosophical Society. Besides contributions to scientific journals, his publications include: *Results of Observation with Zenith Telescope, Sayre Observatory* (1876-95); *Results of Observation with Zenith Telescope, Flower Observatory* (1894-1911); *A Treatise on Practical Astronomy, as Applied to Geodesy and Navigation* (1885; 4th ed., 1903).

**DOOM**, or **DUM PALM** (Ar. *daum*, dwarf palm, from *dāma*, to remain), *Hyphæne thebaica*. A species of palm, with fan-shaped leaves, remarkable for the repeated forkings of its stem, branching being unusual among palms. It is a native of Arabia, Upper Egypt, and the central parts of Africa. In some districts it is the most plentiful tree, sometimes forming forests; it also grows in the bare sands of the desert. Ropes are made of the fibre of its leaf-

stalks. Its fruit is about the size of an orange, but of a somewhat elongated, irregular shape. When the red outer skin is peeled off, a considerable thickness of a spongy dry substance is found within it, which has an insipid sweetness and a remarkable resemblance to gingerbread, so that the tree is sometimes called the gingerbread tree. This substance is used as an article of food, and an infusion of it as a beverage is cooling, gently aperient, and very salutary in fevers. The endosperm of the seed is hard and semitransparent, and is turned into beads and other little ornaments. Each fruit contains one seed.

**DOOM BOOK**. See DOM Boc.

**DOOMSDAY BOOK**. See DOMESDAY BOOK.

**DOOMSTER**. See DEEMSTER.

**DOON**, dōon. A river of Scotland, rising in the southeast of Ayrshire, in Loch Enoch, and flowing towards the northwest through Loch Doon past Dalmellington, Burns's monument, and Alloway Kirk, to the Firth of Clyde, 2 miles south of Ayr (Map: Scotland, D 4). It is 30 miles long. On leaving Loch Doon the river flows through Glen Ness, a picturesque rocky and wooded ravine. On an islet in the loch are the ruins of Doon Castle. Burns has immortalized the Doon in song.

**DOOR** (AS. *dor*, Goth. *daúr*, OHG. *tor*, Ger. *Thor*; connected with Lat. *foris*, Gk. *θύρα*, *thyra*, Ir., Gael. *dorus*, OChurch Slav. *dvǫri*, Lith. *duris*, Lett. *durvis*, Av. *dvara*, Skt. *dvār*, door). A contrivance for closing at will the opening which gives access to a building or room. Its usual form is that of a flat leaf or valve hung on hinges, and secured when closed by a latch, lock, bolt, or other device. It may be of wood, iron, bronze, or even stone or marble. The opening may be closed by a single "leaf," or valve, hung to one door jamb, or, if more than 4 feet wide, by two leaves meeting at the middle of the opening. Wide interior doorways, and doorways of barns and of railway cars may be closed by *sliding* doors, rolling on metal rails set on the inner or outer face of the wall, or in its central plane, in which case the doors, when open, disappear into pockets in the wall. For very wide openings between rooms, as in schools, *accordeon* doors are often used, consisting of a series of narrow valves or leaves hinged together so as to fold back and forth into a narrow space when open. *Storm* doors are removable doors, set outside of an entrance doorway, to provide protection against wind, snow, and rain. In modern buildings the necessity of storm doors is obviated either by two sets of permanent entrance doors with a lobby or vestibule between them, or by the use of Vankannel, or *revolving*, doors; these consist of four leaves at right angles to each other, revolving on a pivot in a cylindrical inclosure. *Double-swing* doors are hung on double hinges to swing either way, out or in. Doors in theatres, churches, and places of public resort are usually by law required to swing out; doors of ordinary rooms swing into the room, the doorway being rebated on that side to receive the door when closed. In rare cases doors slide vertically, being raised by counter weights to open them. *Fireproof* doors are either wholly of metal, or of wood covered with sheet iron, bright tin, or copper. Wooden doors are generally framed in panels, the vertical members of which are called stiles, the horizontal members rails; the panels being generally adorned with moldings. Large

and heavy doors are often made of vertical planks nailed on either side of a strong frame.

The earliest doors in Egypt and Chaldaea and many of those of ancient Greece and Rome were pivoted and not hinged. The famous doors of Balawat (Assyria) were of wood, adorned with bands of sheet bronze bearing reliefs of historic scenes. No Greek doors have been preserved, and of Roman doors the only extant examples are the magnificent bronze doors of the Pantheon (124 A.D.), somewhat altered in the sixteenth century. The Byzantine doors of Hagia Sophia at Constantinople are equally admirable, and Italy possesses many fine bronze doors of the eleventh and twelfth centuries, and even of earlier date (San Paolofuori, Rome; St. Angelo, Monte Gargano; Pisa; Monreale; San Zeno, Verona; and many others). These were made of thin bronze, hammered into reliefs, and applied to paneled frames of wood. With Andrea Pisano's north doors of the baptistery at Florence a new era began in Italy, of doors cast in solid bronze and then chiseled and finished by hand. The doors by Ghiberti for the baptistery (south and east doors; see Ghiberti), by Filarete for St. Peter's, and by L. della Robbia for the sacristy of the Duomo of Florence, are especially celebrated. The carved wooden doors of St. Maclou at Rouen, attributed to Jean Goujon, are fine examples of French Renaissance art, which in its later periods, from Henri IV to Louis XV, produced highly decorative types of wooden doors for mansions and public buildings. Modern bronze doors generally follow the Italian Renaissance types, e.g., those of the capitol at Washington and of St. Bartholomew's at New York. See DOORWAY.

**DOORBA.** See CYNODON.

**DOORNBOOM**, dôrn'bôm (*Acacia horrida*). One of the most common trees of the arid and steppe regions of Africa. The name "doornboom" (thorn tree), given to it by the Dutch colonists, and the botanical specific name, are due to the number and sharpness of its spines. It seldom much exceeds 30 feet in height. In house carpentry its hard, tough timber is much used. This tree yields a gum known as Cape gum, similar to gum arabic. See ACACIA.

**DOORWAY (IN ART).** The opening in a wall to provide access to and exit from a room or building. It may or may not be provided with a door (q.v.) or doors. The vertical sides of the opening are its *jamb*s; the beam or stone which spans the top of a square doorway is its *lintel*, whose under surface is its *soffit*. The woodwork which surrounds an interior doorway is collectively the *door casing*, and the portions of this casing which are visible on either face of the wall constitute the *trim*. It has in all ages been customary to frame or inclose the opening with some form of architectural adornment. The form of the doorway is determined by the architectural style of the building in which it is placed. In Egypt it was always rectangular, surmounted by a strongly projecting cornice. The portals between the great pylons are usually very impressive. That of the temple of Edfu is 74 feet high, with a lintel and cornice 23 feet thick. In Babylonia and Assyria the arched doorway was of brick, often decorated with faience and flanked by protecting colossi; those of the city and palace gates must have been as impressive in their way as the Egyptian. The Persians largely imitated the Egyptians in their scheme of doorways, as

is shown in the palaces of Persepolis and Susa, but surrounded them with banded architraves (q.v.). The primitive Greeks—Pelasgians, Achæans, etc.—used mainly the linteled doorway of huge, often . . . stone (e.g., Lion Gate, Mycenæ), but . . . also the forms of the true and false arch. The historic Greeks confined themselves to the rectangular doorway and evolved a type of which the most perfect example is the famous doorway of the Erechtheum. The Roman doorways were sometimes arched, but oftener rectangular, as in the Pantheon; many of them were of magnificent size and highly ornate, as at Baalbek and Palmyra. In the usual Roman type the doorway was surrounded by a banded architrave and surmounted by a rich cornice, the ends of which were sometimes supported on carved consoles or brackets. In the early Christian style doorways were of comparatively small artistic importance. Those of Byzantine buildings were, however, often of great size and splendor, as in Hagia Sophia, Constantinople, and St. Mark's, Venice.

**Romanesque Doorways.** The eleventh and twelfth centuries developed an entirely new type of doorway, which, originating almost simultaneously in Lombardy and France, spread through Europe. In this type the doorway was formed by a series of arches successively diminishing from the exterior face of the massive walls, the innermost and smallest arch inclosing a rectangular opening under a lintel, above which was a tympanum sculptured in relief. Nook shafts in the angles of the recessed jambs supported the successive arches, which were richly carved. In Italy elaborate canopies on columns often sheltered these doorways. In France figure sculpture was largely used in their decoration, as in the great portals of Saint-Gilles and Saint-Trophime at Arles, in Provence. The portals of Moissac, Vézelay, and Autun, in Burgundy, are hardly inferior. Such doorways were usually in a group of three, the central doorway, leading into the nave, being usually higher and broader than the lateral portals. In many cases a system of floral and geometrical ornamentation was substituted for figure sculpture, especially in England.

**Gothic Doorways.** About the middle of the twelfth century the French builders began to develop the pointed portals, singly or in groups of three, with severer and even more thoroughly architectural sculpture, as in the old cathedrals of Chartres, Bourges, and LeMans, and the Abbey of Saint-Denis. Out of these sprang the unrivaled Gothic doorways of cathedral architecture, of which the masterpieces in the thirteenth century are at Notre Dame (Paris), Amiens, Rheims, and Chartres. To secure sufficient depth for the increased sculptural adornments, and to allow the doorway to become itself a porch in which the worshiper might pray before entering the church, these portals were made to form gabled structures projecting beyond the face of the wall. The carved moldings of the earlier arches were replaced by concentric arched rows of arched under canopies; and life-sized or colossal figures of saints and prophets lined the deep jambs. The scholastic thought of the Middle Ages, its conceptions of the theory and history of the universe, are expressed in the sculptures of these cathedral doorways, which thus acquire an unequalled importance in the history of art. Only seldom is their importance equaled outside of France. In

Italy there are a few fine examples in the north (Verona, San Donnino) and centre (Lucca, Perugia, Orvieto), but it is in the southern region of Apulia that the most beautiful Italian examples occur, especially at Bitonto, Bitetto, Altamura, and their doorways dating from the thirteenth century.

Germany to some extent approached the French style. The portals of Strassburg are equal to the most brilliant French work (especially the portal of the Wise and Foolish Virgins); those of Freiberg and Nuremberg, are not much inferior, but the sculpture was usually neither as systematic nor as generally employed. Even more decidedly French imitations are found in Spain, e.g., in the portals of Burgos Cathedral. English art of the Norman and Gothic periods was far less successful; its doorways were usually insignificant, with but little sculpture and poorly composed with the façade.

**Renaissance Doorways.** The Renaissance returned to a more classic simplicity in doorways, in three principal types: (1) the arched doorway framed in rusticated masonry, as in the Riccardi and Pitti palaces, Florence, and Farnese at Rome; (2) the square-headed or arched doorway flanked by pilasters or columns bearing an entablature with or without a pediment; (3) the square-headed opening framed by a banded architrave carrying an entablature or pediment, often with consoles, as in the beautiful Massimi Palace doorway in Rome. In type (2) the pilasters were often carved with exquisite arabesques, and in north Italy an arched panel above the entablature often took the place of a pediment (Hall of the Two Hundred, Palazzo Vecchio, Florence; San Giobbe, Venice). The French developed monumental variations of these types in the seventeenth and eighteenth centuries. The German Renaissance doorways are low and broad, often adorned with fantastic and grotesque sculpture, as in the Fürstenhof, Wismar, and the extraordinary doorway of the Golden Hall in the castle at Bückeburg (1612); sometimes very rich (Piastenschloss at Brieg; Pfaffenstein Castle). The doorways, with and without pediments, of American Colonial houses are often of great beauty and refinement of design, especially in New England (Salem, Portsmouth, etc.). In modern work the historic styles are generally followed, as in the Romanesque portals of Trinity Church (Boston) and St. Bartholomew's (New York); but both in the United States and in Europe the individual note is often struck in designs of great beauty both of material and carving.

**Bibliography.** Guadet, *Théorie de l'architecture*, vol. 1 (Paris, 1902); Reynaud, *Traité d'architecture* (ib., 1846); Lamoué, *Les portes monumentales de Paris* (ib., no date); Daly, *Motifs historiques d'architecture* (ib., 1870-80); Révoil, *L'Architecture romane du midi de la France* (ib., 1873); and articles "Porte" and "Portail," in Viollet-le-Duc, *Dictionnaire raisonné de l'architecture française* (ib., 1875); Von Siccardsburg, *Die Thür- und Fenstererschlüsse* (Vienna, 1876); Mittarsch, *Das Portal der deutschen Renaissancebauten* (Königsberg, 1911); Cousins, *Fifty Salem Doorways* (New York, 1912).

**DOPPLER, CHRISTIAN** (1803-53). An Austrian physicist and mathematician, born in Salzburg (crownland of that name). He studied at the Polytechnical Institute of Vienna and became an instructor in mathematics there. Sub-

sequently he held various academic appointments, including those of professor of elementary mathematics and practical geometry in the Technical Institute at Prague (1841-47), professor of practical geometry in the Polytechnikum of Vienna (1848-51), and director of the physical institute of Vienna University (1851-53). He is best known as the first to enunciate the well-known Doppler's principle (q.v.) in his monograph, *Ueber das farbige Licht der Doppelsterne* (1842; new ed., 1903). His further works include: *Optisches Diastemometer* (1845); *Beiträge zur Fixsternkunde* (1846); *Versuch einer systematischen Klassifikation der Farben* (1848); *Abhandlungen*, ed. by H. A. Lorentz (1907).

**DOPPLER'S PRINCIPLE.** A law in physics enunciated by Christian Doppler, an Austrian physicist, in 1842. If a body which is emitting waves of any kind recedes from the instrument which is receiving the waves, the wave number is apparently decreased; and conversely, if the vibrating body approaches the receiving instrument, the wave number is increased. Similar statements can be made, in general, of the effect of making the receiving instrument move away from or towards the vibrating source. This alteration in wave number is called "Doppler's Principle," having been first stated in 1842 by Prof. Christian Doppler, of Prague. If the natural velocity of waves in the medium connecting the vibrating body and the receiving instrument is  $V$ , if the velocity of approach of the vibrating body is  $v$ , and if  $N$  is the natural wave number of the waves, the new wave number will be  $N^1$ , where

$$N^1 = N \frac{V}{V - v};$$

whereas, if  $v$  is the velocity of recession of the vibrating body,

$$N^1 = N \frac{V}{V + v}.$$

If, however, the vibrating body is not moving, but the receiving instrument is receding with a velocity  $v$ , then

$$N^1 = \frac{N}{V} (V - v);$$

and if  $v$  is the velocity of approach of the receiving instrument,

$$N^1 = \frac{N}{V} (V + v).$$

Illustrations of Doppler's principle are afforded in acoustics and in light. If a sounding body, e.g., a whistling locomotive, is approaching a listener, the pitch of the note heard is higher than when it is at rest or when receding. Similarly, if a source of light, e.g., a star or one edge of the rotating sun, is approaching an observer rapidly, the color due to any train of waves in the radiation produced in the human eye is not what would be seen if there were no relative motion in the line of sight; the color actually seen will be slightly shifted towards the blue portion of the spectrum. If a photographic plate is used to record the radiation, the actual change in wave number can be measured, and thus an idea obtained of the velocity of the source of light in the line of sight.

**DOR, DORBEETLE, or DOR BUG.** See CHAFER; JUNE BUG.



**DO'RA.** A play by Sardou, produced in 1877 and popular in an English version under the title of *Diplomacy*.

**DORA, SISTER.** See PATTISON, DOROTHY WYNLOW.

**DO'RAB.** A fish (*Chirocentrus dorab*) of the Red Sea, Indian Ocean, and Malayan waters, allied to the herrings, but having some remarkable peculiarities of structure characterizing the separate family Chirocentridæ. "The upward direction of the cleft of the mouth, which is armed with formidable teeth, coupled with the position of the lower jaw, gives a rather peculiar expression to the head, and the eyes are remarkable for being covered with skin. . . . As this fish attains a length of more than a dozen feet, it is a sufficiently formidable monster, and when captured is said to bite viciously at any object within reach. Its flesh is of poor quality."

**DO'RAD.** A mailed catfish of the Amazonian genus *Doras*. See CATFISH; HASSAR.

**DORA D'ISTRIA,** dō'rā dē'strē-ā (1828-88). A pseudonym of Helen Ghika, Princess Koltzoff-Massalsky. She was the niece of Prince Alexander Ghika, Hospodar of Wallachia, and was born at Bucharest, Jan. 22, 1828. Thoroughly instructed in the classics under the care of Professor Pappadopoulos, she added to these, by frequent travels through Germany, France, and Italy, and extensive knowledge of modern languages and literature. At the age of 15 she commenced a translation of the *Iliad* into German and not long afterward wrote several pieces for the theatre. After her marriage with Prince Koltzoff-Massalsky she accompanied her husband to the court of St. Petersburg. Her first important work, *La vie monastique dans l'église orientale*, was published at Paris and Geneva in 1855. This was followed by two works, *Gli eroi della Rumenia* and *I Rumeni ed il papato*. Her studies in Switzerland resulted in a work entitled *La Suisse allemande*. She received an official invitation in 1865 to attend the sixth centenary festival in honor of the birthday of Dante. This event she described vividly in *Pèlerinage au tombeau de Dante*. In 1867 she went to Venice to examine the ample archives of that city; but the first thing she did was to publish *Venise* in 1867. Afterward she showed the fruits of her researches in *Les Albanais musulmans* and *Gli Albanesi nella Rumenia; storia dei principi Ghika nei secoli XVII, XVIII, XIX* (1873). In 1868 she gave some account of her own active life in *Di alcune opere della principessa Dora d'Istria*, a work which reappeared in 1871 under the title *Dora d'Istria e la poesia albanese*. Her work *Des femmes par une femme* (1864) was translated into Russian, Italian, and English. She died at Florence, Nov. 17, 1888.

**DORALICE,** dō'rā-lē'cl-ā. One of the stories in Straparola's *Nights* and an old version of *Cinderella*.

**DOR'AN, JOHN** (1807-78). An English miscellaneous writer, descended from an old Irish family of Drogheda. He was born in London. He acquired from his father, who had lived in France, a good knowledge of French. From 1823 to 1828 he was on the Continent as tutor to a young nobleman. He had already become a contributor to the *Literary Chronicle*. When only 17 he wrote a melodrama, which, under the title of *Justice, or the Venetian Jew*, was produced at the Surrey Theatre in 1824. Four

years later he published a selection from his contributions to the press, *Sketches and Reminiscences*, and, in 1835, *History of Reading*. In 1854 appeared *Habits of Men and Table Traits*, followed by *Lives of the Queens of the House of Hanover* (1855); *Knights and their Days* (1856); *Monarchs Retired from Business* (1857); *History of Court Fools* (1858); *New Pictures and Old Panels* (1859); *The Princes of Wales* (1860); and a *Memoir of Queen Adelaide* (1861). In 1864 he produced his most substantial work, *Their Majesties' Servants*, a history of the stage from Betterton to Kean (new ed., by Lowe, 1887); in 1868, *Saints and Sinners*; and in 1873, his most interesting work, an account of Mrs. Elizabeth Montagu and the "bluestockings" of her day, under the title of *A Lady of the Last Century*. In 1876 appeared *Mann and Manners*, based on the letters of Horace Mann to Horace Walpole, followed by *London in Jacobite Times* (1877) and *Memories of our Great Towns* (1878). After his death was published *In and About Drury Lane*. Doran was closely connected with the *Athenæum* and edited that periodical for a brief period, in 1869. At the time of his death he was editor of *Notes and Queries*.

**DORAS'TUS and FAW'NIA.** The chief characters in Robert Greene's romance, *Pandosto* (1588), and originally the subtitle, in later editions the main title, of the romance.

**DORAT,** dō'rā', CLAUDE JOSEPH (1734-80). A French poet, born in Paris. He was at first an advocate, then a mousquetaire, and finally gave himself up to authorship. His works include almost every form of verse and prose, plays, fables, madrigals, romances, and letters. The plays are decidedly mediocre. He celebrated the "little nothings" of his day in elegant but stilted and affected verse and may be summed up as a boudoir poet. His best-known romances are *Les sacrifices de l'amour, ou lettres de la vicomtesse de Senanges et du chevalier de Versenay* (1771) and *Les victimes de l'amour, ou lettres de quelques amants célèbres* (1776). Consult Desnoiresterres, *Le chevalier Dorat et les poètes légers au XVIIIe siècle*.

**DORAT, JEAN.** See DAURAT, JEAN.

**DOR/CAS** (Lat. gazelle, Gk. δορκάς, *dorkas*, from δέρεσθαι, *derkesthai*, to look, Skt. darś, to see) **GAZELLE.** One of the commonest gazelles (*Gazella dorcas*) of the hilly parts of the central Sahara desert, where in winter it gathers into large herds. It also occurs in Syria. It is about 2 feet high and fawn-colored, with the rump, abdomen, inside of the legs, and ears white; conspicuous white streaks encircle the eyes and curve down to the nostrils. Both sexes bear relatively long and slender horns. It is locally called, by the Sahara Arabs, rhezal and hemar. See GAZELLE, and Plate of GAZELLES.

**DOR/CHESTER.** A municipal borough and the capital of Dorsetshire, England, on the Frome, about 8 miles north of Weymouth (Map: England, D 6). The town is clean and well built and almost surrounded by avenues of beautiful trees. The church of St. Peter contains some curious monuments. Among the other notable buildings are the guildhall, county building, corn exchange, county prison, and barracks. The county museum contains an excellent collection of antiquities. The town owns its water supply, markets, and the corn exchange. Its chief industry is the brewing of



ale and beer, and the production of butter for the London market. Its markets for cattle and cereals are important. Pop., 1901, 9458; 1911, 9842. Near Dorchester are the "Maumbury Rings," the most complete remains of a Roman amphitheatre in England. Its dimensions are 220 by 165 feet, and 30 feet deep. The seats, rising from the arena cut in the chalk, are capable of holding 13,000 spectators. Poundsbury and Maiden Castle are two intrenched camps—the first perhaps of Roman origin, the second of British. Dorchester, British in origin, was the Roman Durnovaria, or Durinum, a walled town with a fosse. The walls are still partly visible. During the Civil War it was fiercely Parliamentary. At Dorchester, in September, 1685, Judge Jeffreys, in his "Bloody Assize," sentenced 292 persons to death for participation in the Monmouth Rebellion.

**DORCHESTER.** A port of entry, the capital of Westmoreland Co., New Brunswick, Canada (Map: New Brunswick, E 3). It is situated on the Memramcook River, 2 miles from Shepody Bay, 12 miles from Sackville, and on the Intercolonial Railway, 115 miles by rail northeast of St. John. It has a good harbor and carries on a considerable export trade in building stone from neighboring quarries, in gas coal, and in lumber. There is a worsted factory. The penitentiary of the Maritime Provinces is on a hill overlooking the town. Pop., 1911, 1080.

**DORCHESTER.** Formerly a town in Norfolk Co., Mass., but since 1870 a ward of the city of Boston. Dorchester was settled in June, 1630, by a company of Puritans headed by their pastors, Maverick and Warham, who came over in the *Mary and John* of Winthrop's fleet. The settlement was originally called Mattapan, but later in the year was incorporated as Dorchester, in the order by the court of assistants, at Charlestown, passed Sept. 17, and which also incorporated Boston. It was named after Dorchester, England, the home of some of the emigrants and of Rev. John White, the prime originator of the movement which resulted in the Massachusetts Bay charter. As a settlement, it antedates Charlestown and Boston, and was described in 1633 as "ye greatest towne in New England." The territory then extended nearly 35 miles, to within a few rods of the Rhode Island line. It instituted the first special town government in New England. From it in 1636 went the company under Roger Ludlow which founded Windsor, Conn.; and also, in 1695, the company which established a settlement of Dorchester in South Carolina and ultimately founded Midway, Ga. By fortifying Dorchester Heights, on March 5, 1776, Washington forced the English to evacuate Boston. The original town comprised Milton, Canton, Stoughton, Sharon, and Foxboro, besides parts of Wrentham, Dedham, the Hyde Park district of Boston, Squantum in Quincy, and South Boston. Dorchester was the birthplace and early home of Edward Everett. Consult: *History of the Town of Dorchester by a Committee of the Dorchester Antiquarian and Historical Society* (Boston, 1859); Orcutt, *Good Old Dorchester: A Narrative History of the Town, 1630-1893* (Cambridge, 1893); Everett, *Dorchester in 1630, 1776, and 1855: An Oration delivered on July 4, 1855* (Boston, 1855).

**DORCHESTER, DANIEL** (1827-1907). A Methodist Episcopal clergyman. He was born

in Duxbury, Mass., and was educated at Wesleyan University, Connecticut. For three terms of four years each he was a presiding elder, and in 1854 he was a member of the Connecticut State Senate. From 1881 to 1885 he was historiographer of the New England Methodist Historical Society and in 1885 was president of the National League (nonsectarian) for the Suppression of the Liquor Traffic and for some time was superintendent of Indian Schools for the United States. Among his published works are: *Concessions of "Liberalists" to Orthodoxy* (1878); *The Problem of Religious Progress* (1881); *Giving and Worship* (1882); *Latest Drink Sophistries Versus Total Abstinence* (1883); *The Liquor Problem in All Ages* (1884); *The Why of Methodism* (1887); *Christianity in the United States* (1888); *Romanism Versus the Public School System* (1888).

**DORCHESTER, LORD.** See CARLETON, SIR GUY.

**DORDOGNE**, dôr'dôny'. A river of south central France, formed by the junction of the Dor and Dogne at the foot of Mont Dore. It flows west through the departments of Corrèze, Lot, Dordogne, Gironde, and joins the Garonne 13 miles north of Bordeaux. It is about 305 miles long and navigable to Souillac, about 186 miles. Ocean steamers ascend to Libourne.

**DORDOGNE.** A southwestern department of France, formed of the ancient Province of Périgord, with small portions of Limousin, Angoumois, . . . (Map: France, E 3). Area, 3561 square miles. Pop., 1901, 452,951; 1911, 437,432. The surface is hilly, with occasional beautiful and fertile valleys, the borders of which are generally covered with vineyards. It has abundant mineral deposits. It raises potatoes, fruits, chestnuts, tobacco, and cattle. Capital, Périgueux (v.).

**DORDRECHT**, dôr'drêkt, or **DORT**. A town of the Netherlands, in the Province of South Holland, situated on an island in the Merwede (Meuse delta), 12 miles southeast of Rotterdam (Map: Netherlands, C 3). The town preserves a mediæval appearance. Its large Gothic Groote Kerk has some beautiful wood carving, a fine nave and tower. The Merwede forms a large, deep harbor. Its trade in wine and lumber is considerable; its products include ships, sugar, chocolate, cigars, metal wares, glass, flour, and lumber. It is a centre for the East India trade, exporting Rhine and Moselle wines, chalk, coal, dried fish, and millstones. Pop., 1900, 38,386; 1910, 47,304. Dordrecht, founded by Count Dietrich III of Holland in 1018, during the Middle Ages was the commercial centre of the country and a member of the Hanseatic League. The first assembly of the independent states of Holland was held here in 1572, and Dordrecht was the meeting place of the famous Synod of Dort (1618-19), which affirmed the doctrines of Calvin. (See DORT, SYNOD OF.) The city was formerly on the mainland, but was separated from it by the flood of 1421. Consult M. Graf, *Beiträge zur Geschichte der Stadt zu Dordrecht* (Basel, 1825).

**DORE**, dôr, or **MONT DORE** (often erroneously written Mont d'Or). A mountain mass in France, comprised in the great group of Auvergne (q.v.). Mountains in the Département of Puy-de-Dôme. They are of volcanic formation and rise in the Puy-de-Sancy, which is the highest peak of central France, to the height of 6190 feet.

**DORÉ**, dō'râ', PAUL GUSTAVE (1833-83). A French illustrator, etcher, painter, and sculptor. He was born at Strassburg. Jan. 6, 1833, the son of an engineer. His talent was very precocious. At the age of 12 he drew sketches for lithographs, and in his fifteenth year he was regularly employed as an illustrator by the *Journal pour Rire*, at the same time exhibiting series of pen sketches in the salons. He had but little education in art, and the demand for his designs was too great to allow him the requisite leisure for technical training. As a caricaturist, he was successful, but he soon turned his attention to the illustration of books. His *Rabelais Illustré*, which appeared in 1854, established his reputation, and this work was followed by an incredible number of others, equally famous. He was not only popular in France, but in the United States and throughout Europe, especially in England, where there was a Doré cult. He worked with amazing facility and fecundity, acquiring great sums of money through his art. He was made a chevalier of the Legion of Honor in 1861 and officer in 1879. He died in Paris, Jan. 23, 1883.

Doré's reputation as an artist is due to his illustrations, in which his weird and fertile imagination and his dramatic sentiment had opportunity for full sway. His drawing, however, is often faulty. He uses landscape with success, especially in order to obtain the weird and gloomy effects in which he excelled. Sometimes, as, e.g., in his last great work, *Orlando Furioso* (1880), his imagination runs riot, and his work becomes exaggerated and bizarre. His chief masterpieces of engraving, besides the *Rabelais*, mentioned above, are *Don Quixote* (1863) and Dante's *Inferno* (1861). Among the numerous other works which he illustrated were Balzac's *Contes drolatiques* (1856), *Atala* (1862), the *Bible* (1864), for which he furnished only the sketches, and La Fontaine's *Fables* (1866). He illustrated a number of important works of English literature, among which are Milton's *Paradise Lost* (1866), Tennyson's *Idylls of the King* (1867-68), Coleridge's *Ancient Mariner* (1876), and Poe's *Raven* (1883).

Doré aspired to be an historical painter and, with his accustomed facility, created many works, mostly of colossal proportions. In these his lack of technical training is particularly conspicuous, especially his faulty drawing and his lack of color sense. The English, however, made much of his painting, and there is still a permanent exhibition of his pictures in London. His first exhibited canvas was the "Battle of the Alma" (1855), and the best of his paintings are "Francesca da Rimini" and the "Neophyte" (1868). His engravings, "Christ Leaving the Temple" and "Entry into Jerusalem," attracted much attention. Doré's landscapes and aquarelles are worse than his figure pieces. In them the artist strives after scintillating effects, but shows no real feeling for nature.

As a sculptor, his technical deficiencies are even more evident. His best-known work is the monument to Alexandre Dumas in the Place Maiesherbes, Paris. But he was more successful in a colossal vase, exhibited in the Exposition Universelle of 1878, and now in Golden Gate Park, San Francisco. The vase represents the "Vintage" and is decorated with numerous little figures of geniuses and animals, in which, in a graceful and delightful manner, the artist has expressed his exuberant fantasy.

Consult: Delorme, *Gustav Doré* (Paris, 1879); Roosevelt, *Life and Reminiscences of Gustav Doré* (London, 1885); Jerrold, *Life of Gustav Doré*; Claretie, *Peintres et sculpteurs contemporains* (2d series, Paris, 1884); Hamerton, in *Fine Arts Quarterly Review*, vol. iii (London, 1864); Beraldi, *Les graveurs du 19ième siècle* (Paris, 1885).

**DORÉE**. A local name in French-speaking parts of Canada for the wall-eyed pike (*Stizostedion*).

**DORÉMUS**, CHARLES AVERY (1851- ). An American chemist, born in New York City. He graduated from the College of the City of New York in 1870 and gained his Ph.D. at Heidelberg. As assistant, and then as adjunct professor of chemistry, toxicology, and medical jurisprudence, he was a member of the faculty of Bellevue Hospital Medical College from 1874 to 1879; he held professorships in the University of Buffalo (1879-82) and in the American Veterinary College, New York (1882-92); and for 22 years taught chemistry and physics (acting professor, 1903-04) at the College of the City of New York. He obtained patents for a mechanical gas furnace and for processes for softening water, for making hydrofluoric acid, for treating kryolith, and for extracting alumina from clay. Besides numerous articles in scientific journals, his publications include *Report on Photography, Vienna Exposition* (1873) and the section "Gaseous Poisons," in the *Text-Book of Legal Medicine and Toxicology* (1903).

**DOREMUS**, ROBERT OGDEN (1824-1906). An American chemist, born in New York City. He graduated in 1842 at New York University, pursued studies in chemistry in Paris in 1847-48, established a chemical laboratory in New York in 1848, and graduated from the medical department of New York University in 1850. In 1861 he was appointed professor of chemistry and toxicology in the Bellevue Hospital Medical College and in 1864 professor of chemistry and physics in the College of the City of New York. He patented several chemical processes, including methods of fire extinguishing.

**DOREMUS**, MRS. SARAH PLATT (HAINES) (1802-77). An American philanthropist, born in New York City. She early became interested in missionary and philanthropic enterprises and was active in organizing the Greek Relief Society in 1828, and in founding permanent homes and hospitals, particularly for women. Among these may be mentioned the Isaac T. Hopper Home for women . . . from prison, the House and School . . . for poor women, and the New York Woman's Hospital. In 1860 she established the Woman's Union Missionary Society. Her efforts in behalf of the wounded soldiers during the Civil War occupy an important place among her many noble works.

**DORÉZ**, LÉON (LOUIS MARIE) (1864- ). A French librarian and writer on the Renaissance. He was born in Villemaur, Aube, and studied at the Ecole des Hautes Etudes, the Sorbonne, and the Ecole des Chartes. In 1890-93 he was in the French School at Rome, and then became an assistant in the Bibliothèque Nationale, where in 1905 he was made librarian of the department of manuscripts. In 1911 he received the honorary degree of LL.D. from St. Andrews University. He edited the *Revue des Bibliothèques* and the *Bibliothèque littéraire de la Renaissance*.

**DORIA**, dō'ri-â, ANDREA (c.1468-1560). A

Genoese admiral. In the first half of his long career he fought in the service of various Italian princes. When Genoa was freed from French domination at the close of the reign of Louis XII, Doria, at the age of about 45 years, was appointed captain general of the galleys and cleared the northern Mediterranean of African pirates. During the first war between Francis I of France and Charles V, Doria commanded the French fleet, reinforced by his own galleys, and inflicted everywhere severe losses upon the enemy. After the defeat of Francis I near Pavia (1525) Doria accepted the command of the papal fleet, but upon the return of the King from captivity entered once more the French service, with the title of High Admiral of the Levant. He blockaded Genoa because it had espoused the cause of the Emperor, but, finding the independence of his country threatened by the French, Doria with his whole force went over to the Emperor and by so doing hastened the deliverance of Italy from French domination. In 1528 Doria entered Genoa without resistance, and, refusing the title of sovereign offered by the Emperor, established a new form of government, which remained in vigor up to the end of the republic. The grateful country decreed him the title of "Father of Peace." In 1532 Doria won a decisive victory over the Turks near Patras, and the conquest of Tunis (1535) was chiefly his work. He distinguished himself in the disastrous expedition of Charles V against Algiers in 1541. Disturbed in his last years by the conspiracy of Fiesco (q.v.), Doria took fierce revenge upon the conspirators for the death of his nephew Gianettino. He died without offspring at Genoa in the ninety-third year of his life. Consult Petit, *André Doria* (Paris, 1887), and Guerrazzi, *Vita di Andrea Doria* (Milan, 1874).

**DORIANS** (Gk. *Dawpeis*, *Dōrieis*, Lat. *Dores*, from Gk. *Dawplis*, *Dōris*). One of the three principal peoples of ancient Greece. According to the legend they took their name from Dorus, the son of Hellen, who settled in Doris (q.v.), which was always regarded by the Dorians as their mother country. The ancestors of the Dorians seem to have come from the north or the northwest, under the pressure of the great southward movement of the Illyrian tribes, which brought to a close the Mycenaean age in Greece. At first they probably occupied much of the later Phocis and Locris, and were only later forced back into the little mountain district of Doris. From the north coast of the Corinthian Gulf they seem to have crossed to the Peloponnesus and to have made extensive voyages from Naupactus. Dorians invaded and occupied Crete, and, though the northern coast of the Peloponnesus was not conquered, other adventurers seem to have attacked by sea Laconia, Argolis, and Corinth. Only in Laconia do the invaders seem to have kept themselves separate from the conquered tribes, and the Spartans were always regarded as the representatives of the unmixed Dorian blood. In Greek legend this conquest of Peloponnesus was connected with the mythical return of the Heraklidae, or descendants of Heracles, and placed about 1104 B.C. It is probable that the migrations did occur during the twelfth and eleventh centuries B.C., or even earlier, and from the north or the northwest. From Peloponnesus the Dorians colonized the southwest corner of Asia Minor and the neighboring islands and planted settlements in Sicily and southern Italy. In historical times the Dorians seem, in general,

characterized by a conservative and somewhat stolid character, though by no means insensible to art and poetry. Consult: K. O. Müller, *Die Dorier* (2d ed., by Schneidewin, Breslau, 1844); Busolt, *Die Lakedaemonier und ihre Bundesgenossen* (Leipzig, 1878); Beloch, "Die Dorische Wanderung," in *Rheinisches Museum*, 45 (1890); Wilamowitz, *Euripides' Herakles* (2d ed., Berlin, 1895); Meister, "Dorier und Achäer," in *Abhandlungen der königlich sächsischen Gesellschaft der Wissenschaften*, 24 (Leipzig, 1904); and the histories of Greece by Grote, Beloch, Busolt, Holm, and Ed. Meyer. For the Doric dialect, see GREEK LANGUAGE.

**DORIC ORDER.** The oldest and simplest of the three Greek orders and the second of the five Roman orders, as usually enumerated. See ORDERS OF ARCHITECTURE.

**DORID.** A sea slug. See NUDIBRANCHIATA and accompanying Colored Plate.

**DORIGNY**, dō're'nyé', NICOLAS (1657-1746). A French engraver and painter. He was born in Paris and was the most celebrated of a well-known family of artists. His father, MICHEL (c.1617-65), a pupil of Vouet, was a painter and line engraver who developed a peculiar technique well suited to reproduce Vouet's pathetic style. His brother LOUIS (1654-1742), a clever fresco painter and etcher, was a pupil of Lebrun and afterward went to Verona, where he lived many years. Most of his work is still in that city. During a visit to Austria he executed his best work, the frescoes in the church of Santa Maria Maggiore at Trent (since destroyed), and decorative paintings for the present Ministry of Finance in Vienna. Nicolas was a pupil of his father. He spent 28 years in Italy and after his return to France was called to England by Queen Anne to engrave Raphael's cartoons at Hampton Court (see RAPHAEL), representing scenes from the New Testament. After this commission, which required from 1711 to 1719, he returned to Paris and was made a member of the Academy (1725). He is the first of the noted Raphael engravers and reproduced many other old masters. His technique is richer and more varied than that of his father, and his art, which was influenced by Audran, marks the transition from the seventeenth to the eighteenth century. His paintings were of historical and religious subjects and are of less value.

**DORION**, Fr. pron. dō'rë'ôn', SIR ANTOINE AIMÉ (1818-91). A Canadian statesman and jurist. He was born at Sainte Anne de la Pérade, Province of Quebec, was educated at Nicolet College, and was admitted to the bar in 1842. He represented Montreal from 1854 to 1861 and Hochelaga from 1862 to 1867 in the Legislative Assembly of the Province of Canada, and after confederation was a member of the Dominion Parliament for Hochelaga from 1867 to 1872 and for Napierville from then until 1874. With L. J. Papineau (q.v.) he was one of the founders, and during his political career a leader, of "Le Partie Rouge," the advanced section of French-Canadian Liberals, corresponding in some degree to the "Clear Grits" of Upper Canada (Ontario). (See POLITICAL PARTIES, *Canada*.) In 1858 he was Commissioner of Crownlands and French-Canadian leader in the famous two-days-long Brown-Dorion administration. In 1859, dissatisfied with the legislative union of Upper and Lower Canada, he helped to set on foot a movement for the federation of those provinces. In

1862 he became Provincial Secretary in the Macdonald-Sicotte administration and in 1863-64 was again French-Canadian leader in the Macdonald-Dorion administration, of which John Sandfield Macdonald (q.v.) was Premier. After confederation Dorion in 1873 became Minister of Justice in the Liberal administration of Alexander Mackenzie. In 1874 he was appointed Chief Justice of the Province of Quebec, a position he adorned for 17 years.

**DORIS** (Lat., from Gk. *Δωρίς*). A small mountainous district of ancient Hellas, between Phocis, Ætolia, and Locris, the original home, tradition said, of the Dorians (q.v.). With its four towns, Boium, Cytinium, Erineus, and Pinus, it formed the Doric Tetrapolis, which suffered severely in the Phocian, Ætolian, and Macedonian wars. Doris was also the name of the southwestern part of Caria, together with the islands of Cos and Rhodes, where were situated Dorian colonies, which formed at one time a hexapolis. In modern Greece Doris forms an eparchy in the nomarchy of Phocis. Consult Lolling, in *Athenische Mittheilungen*, vol. ix (Athens, 1884).

**DORIS**. See **NUDIBRANCHIATA**.

**DORISLAUS**, dōrēs-lous, ISAAC (1593-1649). A Dutch-English scholar, lawyer, and diplomatist, born at Alkmaar, North Holland. He studied at the University of Leyden, removed to England, and in 1627 was appointed to the chair of history, newly established at Cambridge. By Lord Brooke, and first offered to him. From this professorship he was compelled to withdraw for his justification of the Dutch revolt against Spain. In 1629 he became a commoner of the College of Advocates, about 1640 was appointed Judge Advocate, and in 1648 a judge of the Court of Admiralty. He assisted in the trial of Charles I, and in 1649 was sent by the Council of State of the Commonwealth to conclude a treaty between England and the Dutch Republic. He was murdered at The Hague by a party of Royalists on May 12, 1649, an attack the day before having failed.

**DORKING**. A market town of Surrey, England, in a picturesque valley on the Mole, 26 miles south-southwest of London, on the ancient Roman road between London and Chichester (Map: England, F 5). Its chief trade is in flour; and in lime and chalk from adjacent pits. Dorking gives its name to a five-toed breed of domestic fowl. Pop., 1901, 7670; 1911, 7850. Near the town is Deepdene, the beautiful countryseat of the Duke of Marlborough, where Disraeli conceived and wrote part of *Coningsby*.

**DORKING** (from *Dorking* in England). A long-established breed of domestic fowls, distinguished chiefly by the presence of a fifth toe on the hinder part of the foot below the spur. The breed is especially valuable for the table. See **FOWL**, and Colored Plate of **FOWLS**.

**DORKING, BATTLE OF**. The history of an imaginary invasion of England, written by Gen. George J. Chesney, in 1871, to call attention to the weakness of British defenses.

**DORMANT** (Fr., sleeping). A term in heraldry denoting an animal in a sleeping or recumbent attitude, with its head resting on its forepaws.

**DORMER** (OF. *dormeor*, sleeping room, from Lat. *dormitorium*, from *dormire*, to sleep; so called as being primarily a bedroom window), or **DORMER WINDOW**. A structure, usually gabled, projecting from a sloping roof to hold a ver-

tical window, for the lighting of a room or other space under the roof. The structure may extend out to the plane of the wall, and its front be of masonry resting upon the wall, as in the more monumental types; or the whole structure may be of wood or metal, set farther back and higher up on the roof slope. The dormer appears in early Gothic buildings and becomes a rich feature of late Gothic stone and timbered architecture and of the Renaissance in France and those northern countries where steep roofs abound.

**DORMITORY** (Fr. *dormitoire*, Lat. *dormitorium*, from *dormire*, to sleep). 1. A sleeping apartment containing several beds, especially one in a large institution, asylum, or school. The dormitories of mediæval monasteries were often of artistic interest, being large halls divided lengthwise by rows of columns. They were of two types: (a) The open hall where all slept, together or in cubicles separated merely by low wooden partitions, with hangings at the entrances; (b) a building with separate cells opening from a corridor. The first was the primitive Benedictine type and was brought back among the Cistercians by St. Bernard, but the self-indulgent Order of Cluny (tenth century) had allowed to each monk a separate cell, and this became the general custom after the fourteenth century. 2. A college building containing living rooms for students (especially in American usage).

**DORMOUSE** (from archaic *dorm*, to sleep, from Icel. *dorma*, from Lat. *dormire*, to sleep + *mouse*). A small, arboreal rodent of the Old World family Muscardinidæ. The dormice, in adaptation to a squirrel-like existence, have come to resemble those animals in miniature, but in organization are much more nearly allied to the true mice (Muridæ). There are four molar teeth on each side in each jaw, their summits marked by transverse ridges. There are no cheek pouches and no cæcum. The ears resemble those of mice. The fur is very fine and soft. The tail is long and somewhat squirrel-like. The dormice are beautiful little animals, natives chiefly of the south of Europe; but some species are also found in Asia and Africa, and the genus *Graphiurus* is entirely African. Four genera, containing about a dozen species, are included in the family. The best-known species is the red dormouse, muscardine, or hazel mouse (haselmaus) (*Muscardinus avellanarius*), an inhabitant of woods in most parts of Europe. It is about the size of a house mouse, with head proportionally large; has a rather pointed muzzle, large prominent eyes, and a flattened tail thickly clothed with rather long hair; and is of a tawny red color on the upper parts and white beneath. It is extremely gentle and easily tamed; feeds on beech mast, acorns, hazelnuts, grain, etc.; and spends the colder parts of winter in a state of torpidity, although in mild weather it wakens up to consume a little of the store of food which, like squirrels, it lays up for that season. It makes a nest of tangled or interlaced herbage, entered from above, usually in some copse or underwood, and produces about four young ones at a birth. It often assumes a remarkable posture in feeding, suspending itself by its hind feet; more generally it sits upon its haunches and holds its food in its forepaws. The fat dormouse (*Myomys*, or *Glis glis*) is a larger species, grayish brown, about the size of a rat, with a tail very much like that of a squirrel,

and is a native of the south of Europe, where it inhabits forests, leaping from branch to branch with great agility. The garden dormouse (*Eliomys nitela*, or *Dymomys nitedula*), common in Europe as far north as Poland, is frequently found in gardens and even in outhouses. It is often very destructive of the fruit of wall and espalier trees. It is rather smaller than the fat dormouse and has the tail tufted only at the extremity. It is called lerot in France and Gartenschläfer in Germany.

**DORN, ALEXANDER VON** (1838- ). An Austrian economist, born at Wiener-Neustadt. He became editor of the *Triester Zeitung* in 1872 and in 1884 established at Vienna the *Volkswirtschaftliche Wochenschrift*—a publication followed in 1888 by the *Exportkompass*, a commercial yearbook of the Austro-Hungarian monarchy. He was editor of the illustrated work entitled *Die Seehäfen des Weltverkehrs* (1889 et seq.) and in 1885 published the important work *Kriegsmarine und Volkswirtschaft in Oesterreich-Ungarn*. He wrote also *Amerikanisches* (1900).

**DORN, EARL VAN.** See VAN DORN.

**DORN, JOHANN ALBRECHT BERNHARD** (1805-81). A Russian Orientalist, born at Scheuerfeld, Duchy of Coburg. He studied at Halle and Leipzig and later successively became professor of Oriental languages at the University of Kharkov (1826), professor of the history and geography of Asia at the Oriental Institute, St. Petersburg (1835), director of the Asiatic Museum (1842), and chief librarian of the Imperial Public Library (1843). His works, which are devoted to the history and language of Afghanistan and Caucasus, include: *Ueber die Veranlassung des persischen, germanischen, und griechisch-lateinischen Sprachstammes* (Hamburg, 1827); *Auszüge aus muhammedanischen Schriftstellern* (St. Petersburg, 1858); *Catalogue des manuscrits et xylographes orientaux de la Bibliothèque Impériale* (1852); *Caspia: Ueber die Einfälle der alten Russen in Tabaristan* (1875); *A Chrestomathy of the Pushtû, or Afghan Language* (with a glossary, 1847); *History of the Afghans, translated from the Persian of Nî'mat Allah* (2 vols., 1829-36). The two works last-mentioned were written by the author in the English language.

**DORNER, dör'nër, AUGUST JOHANNES** (1846- ). A German theologian and philosopher, son of Isaac August Dörner. He was born in Schiltbach, Baden, and was educated at the universities of Berlin, Göttingen, and Tübingen. In 1869 he was minister of German congregations in Lyons and Marseilles. He traveled in the Orient, became a teacher at Göttingen (1870), and after a trip to North America in 1874 became professor and director of the Wittenberg Theological Seminary. In 1890 he went to Königsberg and in 1908-09 was rector of the university. He edited his father's correspondence with Martensen (1888) and his *System der christlichen Sittenlehre* (1885); and he wrote: *Augustinus* (1873); *Kirche und Reich Gottes* (1883); *Predigten vom Reiche Gottes* (1880); *Dem Andenken von I. A. Dörner* (1885); *Das menschliche Erkennen* (1887); *Das menschliche Handeln, philosophische Ethik* (1895); *Grundriss der Dogmengeschichte* (1899); *Encyclopädie der Theologie* (1901); *Grundriss der Religionsphilosophie* (1903); *Heilsglaube und Dogma* (1905); *Die Entstehung der christlichen Dogmen* (1907); *Pessimismus, Nietzsche,*

*und Naturalismus* (1911); *Die Metaphysik des Christentums* (1913); and many contributions to theological journals.

**DORNER, ISAAC AUGUST** (1809-84). A German theologian. He was born at Neuhausen ob Eck, Württemberg, June 20, 1809, the son of a Lutheran minister. He studied at Tübingen and became a professor there in 1837, at Kiel, 1839, and in 1843 professor of divinity and counselor of the consistory at Königsberg. From 1847 to 1853 he held a chair at Bonn, then removed to Göttingen, and in 1861 was appointed professor of systematic theology and exegesis in the University of Berlin. His best-known work is the *History of the Development of the Doctrine of the Person of Christ* (1861-63). Other works, translations of which have been published, are: *History of Protestant Theology* (1871); *System of Christian Doctrine* (1880-84); *Christian Ethics* (1887). He died at Wiesbaden, July 8, 1884. He was a strong upholder of Christianity as opposed to Germanism. His eschatological views, which were not fully in accord with the prevalent theology, were separately translated by Newman Smyth, *Dörner on the Future State* (New York, 1883). Consult the important *Briefwechsel zwischen H. L. Martensen und I. A. Dörner* (Berlin, 1888). Consult also Pfeiderer, *The Development of German Theology Since Kant* (New York, 1890).

**DOR/NICK, DORNIC, or DORNOCK.** A species of stout linen cloth woven in a simple diaper pattern. Dornicks were formerly made in considerable quantity at Dornich, or Tournay, in the Netherlands, and hence their name. From this place the manufacture was probably carried to Norfolk, England, by the Dutch, who emigrated thither during the persecution of the Duke of Alva.

**DORNOCH, dör'nôc.** A royal burgh and the capital of the County of Sutherland, Scotland, situated on the north shore, near the entrance to the Dornoch Firth—an inlet of the North Sea, running 25 miles inland, and separating Sutherlandshire from Ross and Cromarty (Map: Scotland, D 2). The cathedral, built about 1245 by Bishop Gilbert Murray, was partially burned in 1570, but was restored in 1837 and is now used as the parish church. Dornoch was in olden times the residence of the bishops of Sutherland and Caithness. The castle, which was the bishop's palace, was destroyed in 1570, and only its west tower remains. The town is a favorite summer resort on account of its excellent golf links and sea bathing. Skibo Castle, 4 miles west of Dornoch, was bought in 1898 by Andrew Carnegie. Pop. (of municipal burgh), 1901, 624; 1911, 741.

**DORNROSCHEN, dörn'rës-ken.** The German equivalent for 'The Sleeping Beauty.'

**DOROHOL, dô'rô-hô'ë.** A town of northern Rumania, situated near the Austrian frontier (Map: Turkey in Europe, F 1). It is connected by rail with Jassy and has a population of (1899) 12,701, of whom nearly 7000 are Jews. A lively trade in timber is carried on in the town. An annual fair is held on the 12th of June.

**DOR/OTHE'A.** 1. An unfortunate lady, whose story is told in Cervantes' *Don Quixote*. 2. The heroine of Goethe's idyllic poem "Her-mann and Dorothea." 3. The courageous Scottish Queen in Greene's *James the Fourth*, who

sacrifices herself for the good of her country. 4. The overserious Miss Brooke in George Eliot's *Middlemarch*.

**DOROW**, dō'rō, WILHELM (1790-1846). A German archæologist, born in Königsberg. He held various diplomatic positions from 1812 to 1827. In the latter year he visited Italy, where he began an important series of excavations which resulted in numerous discoveries and the valuable collection of Etruscan antiquities now owned by the Berlin Museum. He published: *Opferstätten und Grabhügel der Germanen und Römer am Rhein* (2 vols., 1819-21); *Etrurien und der Orient* (1829); *Voyage archéologique dans l'ancienne Etrurie* (1829).

**DOROZSMA**, dō'rōzh-mō. A market town of Hungary, in the County of Csongrad, about 10 miles west-northwest of Szegedin. It is in the midst of a fertile country, the inhabitants of which are largely engaged in cattle raising. There are several salt lakes near by. The town was almost wiped out by an inundation of the Theiss in 1879. Pop., 1900, 15,014; 1910, 17,719.

**DORPAT**, formerly also written **DÖRPT** (Russian official name *Yuriev*, Esth. *Tartolin*, Lett. *Tehrpatā*). A town in the Russian Government of Livonia, on the Embach, 163 miles southwest of St. Petersburg (Map: Russia, C 3). The fame of the town is due to its university. The Domberg, situated at the northwest extremity of the town, was formerly occupied by a citadel, a cathedral, and a bishop's palace; it now is the site of an observatory, a library, and a number of buildings connected with the university. Dorpat has a number of Protestant churches, a town hall, a monument to Barclay de Tolly, a native of Dorpat, fine promenades, and a botanical garden. It is protected by dikes from the overflowing of the Embach. Besides the famous university there is a teachers' seminary, a veterinary school, several gymnasias, and a number of scientific societies. In industrial importance Dorpat occupies in Livonia a position next to Riga. Its situation at the meeting point of the Riga, Peman, Revel Narva, and Pskov roads confer on it trade advantages which have benefited its inhabitants. There are a number of manufacturing establishments. The population (42,421 in 1897) was 44,140 in 1911, consisting principally of Estonians and Germans, including also some Russians and Jews. The official language is Russian, but German is spoken by a large proportion of the inhabitants. Dorpat is believed to have been founded by Prince Yaroslav I in 1030. With its capture by the Teutonic Knights in 1225 the town became the seat of a bishop and subsequently a commercial centre and a member of the Hanseatic League. In 1559 it was captured by the Russians, who in 1582 ceded it to Poland. It was subsequently taken by the Swedes, the Poles, and the Russians. In 1704 it came into the permanent possession of Russia. In 1708 the Russians nearly destroyed the town and removed the inhabitants to the interior of Russia. Consult Hausmann, *Aus der Geschichte der Stadt Dorpat* (Dorpat, 1872).

**DORPAT UNIVERSITY**. See YURIEV UNIVERSITY.

**DÖRPFELD**, dērp'fēlt, WILHELM (1853- ). A German archæologist. He was born at Barmen and was educated at the Bauakademie, Berlin. From 1877 to 1881 he took part in

the excavations at Olympia (q.v.), becoming director of the technical operations there in 1878. In 1887 he was appointed secretary of the German Archæological Institute at Athens, with which institution he had for several years been associated as architect. He conducted excavations in many parts of the ancient Greek world, notably in connection with the study of the ancient Greek theatre; the results of these were set forth in Dürpfeld-Reisch, *Das griechische Theater* (Athens, 1906). This book was elaborately examined by Goodell, in *American Journal of Philology*, vol. xviii (1897). He occasionally co-operated with Schliemann (q.v.), and completed his excavations at Troy. He was collaborator with Curtius and others on the work entitled *Ausgrabungen zu Olympia* (1877-81) and assisted Schliemann in the preparation of the publications *Troja* (1884) and *Tyrins* (1886). He wrote *Troja und Ilion* (2 vols., 1902), and published many articles in archæological journals, on the results of excavations, conducted by himself or others, in widely separated parts of the Greek world.

**DORR**, JULIA CAROLINE (RIPLEY) (1825-1913). An American author. She was born at Charleston, S. C., but early removed to New York and then to Rutland, Vt., where she married Hon. Seneca R. Dorr. She wrote much from her earliest years, but published nothing till 1848, when her verse and prose began to take a prominent place in American literature. Among her books are: *Isabel Leslie* (1854); *Farmingdale* (1854); *Lanmere* (1856); *Sybil Huntingdon* (1869); *Expiation* (1872); *Bermuda* (1884); *The Flower of England's Face* (1895); *A Cathedral Pilgrimage* (1896); *In King's Houses* (1898). She is best known, however, for volumes of thoughtful, artistic verse: *Poems* (1871); *Friar Anselm and Other Poems* (1879); *Daybreak: An Easter Poem* (1872); *Afternoon Songs* (1885); *Afterglow* (1900); *Beyond the Sunset* (1909); *Last Poems* (1913). A collected edition of her poems appeared in 1892.

**DORR**, RHETA CHILDE. An American author and social worker, born in Omaha, Neb. After studying for two years at the University of Nebraska she became editor of the woman's department of the *New York Evening Post* (1902-06), and a member of the staff of *Hampton's Magazine* (1908-11). She made special investigations as a worker in factories, mills, and department stores in order to study the labor conditions for women and children. Besides magazine articles, she is author of *What Eight Women Want* (1910).

**DORR**, THOMAS WILSON (1805-54). An American politician, famous as the leader of "Dorr's Rebellion" in Rhode Island. He was born in Providence, R. I., graduated at Harvard in 1823, studied law and was admitted to the bar, was a member of the State Assembly from 1833 to 1837 and became identified with the movement for an extension of the right of suffrage in the State. By an Act of 1798 the suffrage had been granted only to those who had a freehold valued at \$134 or bringing an annual rental of \$7. The apportionment of representatives, moreover, was unfairly made, Providence and Portsmouth, e.g., having the same number, though in 1840 the population of the former was 20 times as great as that of the latter. A suffrage party organized (1840) to effect the needed reforms called a constitutional convention, which met in October and framed a consti-



tution which in December was accepted by a large majority of the people. A constitutional convention called by the Legislature adopted a constitution (in February, 1842) which was rejected at the polls. In April the "Suffragists" elected Dorr Governor, while the opposing party, or "Landholders," chose Samuel W. King; both were formally inaugurated. In answer to a "Suffragist" attempt to seize the arsenal at Providence, Governor King, on May 18, proclaimed martial law. Dorr made an effort to secure the support of the Federal authorities at Washington, but failed, and returned to Rhode Island, where his support soon collapsed. He fled to Connecticut, but upon his return was arrested, convicted of high treason, and, in June, 1844, sentenced to imprisonment for life. In 1845, however, he was released. Though the methods of Dorr were revolutionary and unwise, they served to attract general attention to the archaic and inequitable provisions of the State constitution and led to the adoption in November, 1842, of the present constitution. By its provisions, and by amendments passed in 1886, 1888, and 1893, the suffrage has at last been made virtually universal. Consult King, *The Life and Times of Thomas W. Dorr* (Boston, 1859), and Mowry, *The Dorr War* (Providence, 1901).

**DORRANCETON.** A borough in Luzerne Co., Pa., opposite Wilkes-Barre, on the Susquehanna River, and on the Delaware, Lackawanna, and Western Railroad. It is purely residential and contains a hospital. Pop., 1900, 2211; 1910, 4046.

**DORRIFORTH.** A character in Mrs. Inchbald's *Simple Story*.

**DORRIT, AMY.** The unselfish heroine of Dickens's novel, *Little Dorrit*.

**DORR'S REBELLION.** See DORR, THOMAS WILSON.

**D'ORSAY, dôr'sâ', ALFRED GUILLAUME GABRIEL, COUNT (1801-1852).** A French gentleman, famous chiefly as a leader of society in London and Paris. Through a morganatic marriage he was a grandson of the King of Württemberg and his family known for its devotion to the Bonapartes. In December, 1827, he married Lady Harriet Gardiner, then 15 years of age, the daughter of the English Earl of Blessington. The union was not happy and was dissolved soon after Blessington's death, in 1829. From that time until his death D'Orsay lived near the Countess of Blessington and made her residence at Gore House the centre of the fashionable, artistic, and literary society of London. In 1849 the change of government brought about their return to Paris, where D'Orsay painted a portrait of ex-King Jerome, executed busts of Lamartine and Prince Napoleon, and just before his death was appointed director of fine arts. He was tall and well built, was strikingly handsome, and was an excellent conversationalist, and for many years was regarded as an *arbitre elegantiarum* and the beau ideal of the fashionable gentleman. An accurate description of him is given by Disraeli in his novel *Henrietta Temple*, where D'Orsay appears as "Count Mirabel." Consult Richard Madden, *Life of Lady Blessington* (London, 1855).

**DORSE** (Ger. *Dorsch*, haddock, Dan. *torsk*, Eng. also *torsk*, tusk). The Baltic cod (*Gadus callarias*), a variety of the common cod, found in the Baltic and the neighboring seas.

**DORSET** or **DORSETSHIRE** (from AS.

*Dorsæte*, from *dor*, water, from OWelsh *dubr*, Welsh, *dufr*, Corn. *dofer*, *dour*, Ir. *dobar*, Gall. *dubron*, water + AS. *sæte*, settlers + *scire*, *scyre*, shire). A maritime county in the south of England, on the English Channel, between Devonshire and Hampshire (Map: England, D 6). It is an agricultural and stock-raising county, with an area of 987.9 square miles. Pop., 1901, 202,063; 1911, 223,274. On the east shore is Poole Harbor, a deep, lakelike inlet, south of which are the Isle of Purbeck and, to the west, St. Albans Head, Weymouth Bay, and Portland Roads. Along this coast are Lyme Regis, Charmouth, Bridport, Weymouth, Lulworth, and Swanage, all attractive watering places. Inland the surface is mostly irregular, the ranges in the southeast occasionally reaching an altitude of nearly 1000 feet. The principal rivers are the Stour, the Cale, the Liddin, the Frome, the Yeo, and the Char. The county contains a number of valuable prehistoric ruins, the most noted of which is Maiden Castle, near Dorchester, which was probably erected many years before the Roman invasion. Many interesting relics of the Roman occupation have also been discovered. Capital, Dorchester (q.v.).

**DORSET, EARL OF.** See SACKVILLE.

**DORSEY, GEORGE AMOS (1868- )**. An American anthropologist, born at Hebron, Ohio. He graduated from Denison University in 1888, studied at Harvard, made anthropological investigations in South America, and was superintendent of archæology in the department of anthropology at the Chicago Exposition (1892-93). After two years of teaching at Harvard he became assistant curator of anthropology (1896) at the Field Museum of Natural History, Chicago, and curator (1898). He also served as professor of comparative anatomy in the dental school of Northwestern University, as assistant professor of anthropology and associate professor (after 1908) at the University of Chicago, and as a member of the editorial staff of the *Chicago Tribune*. For the Field Museum he traveled through Europe, Africa, Asia, and Australasia in 1908. Dorsey was president of the American Folklore Society in 1903. He is author of more than 70 papers on anthropology and anatomy.

**DORSEY, JAMES OWEN (1848-95).** A distinguished American anthropologist, born in Baltimore, Md. After a course at the Theological Seminary of Virginia he was ordained a deacon in the Protestant Episcopal church in 1871 and assigned to missionary work among the Ponca and Omaha Indians of South Dakota and Nebraska. Through his linguistic and sociologic studies among these tribes he was led to form a connection with the Bureau of American Ethnology, of which he continued an active and useful member until his death, devoting special attention to the Siouan tribes. His most important work is that upon the Dhegiha language, published under the auspices of the bureau, besides which he is the author of numerous contributions in bureau reports and other scientific publications.

**DORSEY, STEPHEN WALLACE (1842- )**. An American politician. He was born in Benson, Vt., and removed in early life to Oberlin, Ohio. He served in the Union army during the Civil War, becoming colonel of volunteers. Elected president of the Arkansas Central Railway in 1869, he removed to Arkansas, where he became prominent in reconstruction politics and



was chosen chairman of the Republican State Committee. In 1873-79 he was United States Senator, being chosen by the almost unanimous vote of both the Democratic and Republican members of the State Legislature. He was a member of the Republican National Committee in 1872, 1876, and 1880, in the last year being secretary. He was implicated in the "Star Route" frauds and indicted but escaped conviction. After 1880 he retired from politics.

**DORSIVENTRALITY** (from Lat. *dorsum*, back + *venter*, belly). In plants, a term of symmetry, indicating that a structure has two dissimilar (dorsal and ventral) faces, which are differently related to the environment. For example, the thallus body of an ordinary liverwort, like *Marchantia*, is dorsiventral. It is prostrate, so that one surface (the dorsal) is exposed to the air and sunlight, and the other (the ventral) is in contact with the earth or other substance on which the plant grows. As a consequence of these different exposures, the two surfaces are not only unlike in appearance, but they give rise to different organs. In *Marchantia*, e.g., the dorsal tissues, being exposed to light, develop chlorophyll, and the dorsal surface, being free, gives rise to the reproductive structures; while the ventral surface puts out rhizoids (simple rootlike structures) which penetrate the substratum and act as holdfasts. Ordinary horizontal leaves are illustrations of dorsiventral organs, the two surfaces usually differing in appearance, and the dorsal and ventral tissues differing even more decidedly in their arrangement. For example, the dorsal (upper) epidermis of such a leaf is often made up of compact cells without stomata ("breathing pores"), and is covered by a well-developed cuticle; while the ventral (lower) surface contains multitudes of stomata and may be hairy. In such a leaf the dorsal working cells (mesophyll) are closely packed together to form a dense tissue, while the cells of the ventral mesophyll are loosely aggregated. These differences in structure are due to the character of the exposure, as is evidenced by the fact that if a very young dorsiventral leaf is fixed in an inverted position, the normally dorsal region will develop the ventral arrangement of tissues and vice versa. Many underground stems, such as those of the common ferns and the ordinary rootstocks of seed plants, are dorsiventral, giving rise to roots beneath and leaves or branches above. As contrasted with a dorsiventral structure, the "radial structure" is one in which all sides are exposed alike, and such organs as are produced are repeated uniformly about the centre, as in an ordinary upright stem with its radially arranged leaves. See LEAF.

**DORSTENIA**. See CONTRAYERVA.

**DORT**. See DORDRECHT.

**DORT, SYNOD OF**: The largest and most important legislative council ever held by the Reformed churches, the confessional outcome of which, the "Canons of the Synod of Dort," have binding doctrinal force upon the Reformed Dutch churches. It was convened on Nov. 13, 1618, dissolved May 9, 1619, and held 154 formal sessions. Its expenses, amounting to over 100,000 guilders, were borne by the States-General of Holland, which convened it and invited all branches of the Reformed church to participate. It consisted of 84 clerical and 18 secular delegates. Of these, 58 were Dutch, England sent 8, the Palatinate and Hesse 7, Switzerland 7,

Bremen, 3 delegates. Those appointed by Brandenburg were excused on account of age; those by the National Synod of France were forbidden by the King to leave the country. The ostensible object of the gathering was to compose doctrinal differences in the church; its practical outcome was the condemnation of Arminianism as represented by the Remonstrants, defended by Barneveldt, Grotius, and most eloquently by Simon Episcopius; but opposed by the government, headed by the Stadtholder, Prince Maurice of Nassau. The entire Dutch delegation were orthodox; Utrecht alone sent Arminian delegates, and they were not allowed to sit. The synod listened to the arguments of the Remonstrants, but was uninfluenced by them. On May 8, 1619, it was voted, Hesse and England alone dissenting, that the Arminians should be excluded by the synods and classes from their ecclesiastical places. This drastic order was subsequently ruthlessly executed. The canons adopted are rigorously Calvinistic and cover the famous five points: (1) Divine Predestination; (2) Death of Christ [limited atonement]; (3) Corruption of Man; (4) Irresistible Grace; (5) Perseverance of the Saints. The Belgic Confession and the Heidelberg Catechism were also adopted, and a revision of the Dutch Bible from the Hebrew and Greek was ordered. The closing of the Synod of Dort was followed within a few days by the execution of Barneveldt, the political leader of the Arminians and the victim of the jealousy and hatred of Maurice of Nassau. Consult Schaff, *Creeds of Christendom*, vol. i, and for text, id., vol. iii (New York, 1884), and Curtis, *History of Creeds and Confessions of Faith* (Edinburgh, 1911). See ARMINIUS; EPISCOPIUS; GOMARUS.

**DORTMUND**, dôrt'munt. The largest city of the Prussian Province of Westphalia, and a notable mining centre, situated near the Emscher, about 73 miles northeast of Cologne (Map: Prussia, B 3). The Dortmund and Ems Canal connects the city with the Dollart at Emden, 150 miles away. The city was formerly surrounded by a massive wall, which has been removed, and the site is now marked by handsome promenades. Four of its churches are worthy of notice: the church of St. Reinoldi, of the thirteenth century; St. Mary's, built about 1150, in the Romanesque style; St. Peter's, completely restored; and the Roman Catholic parish church. The weather-beaten Rathaus, dating from the thirteenth century, restored in 1899, is still extant. Its institutions embrace two municipal gymnasia, an industrial school, numerous elementary schools, and a municipal theatre. Dortmund is in the most fertile part of Westphalia and is an important railway centre. Situated in the midst of a coal-mining district, its iron industry has grown rapidly. One large corporation, the Harpen Mining Company, employs 26,000 men; the Dortmund Union Iron Works, 12,000; the Hüsche Iron and Steel Works, 9800. It manufactures locomotives, cars, and various kinds of heavy machinery. There are flour and saw mills and numerous breweries; the zinc industry is also important. Pop., 1900, 142,418; 1910, 214,226. It is first mentioned in 899, became eventually a free Imperial city, and finally joined the Hanseatic League. It began to decline in the fifteenth century and especially from the time of the Thirty Years' War, but has grown phenomenally since the Franco-Prussian War. Consult: Thiersch, *Geschichte der*

*freireichstadt Dortmund* (Dortmund, 1854); Rübél, *Dortmunder finanz und steuerwesen* (ib., 1892); Sievers, *Übersichtskarte der Berg- und Huttenwerke im Oberbergamtsbezirk Dortmund* (Leipzig, 1890); A. Shadwell, *Industrial Efficiency* (London, 1906).

**DOR'Y**, or **DORE**, dō-rā' (Fr. *dorée*, gilded Lat. *deaurare*, to gild, from *de*, down + *aurum*, gold). 1. A local name about the upper Great Lakes for the wall-eyed pike. (See **PIKE PERCH.**) 2. See **JOHN DORY**.

**DORYPHORUS**, dō-rif'ō-rūs. See **ATHLETE**, **THE**.

**DOSITHEANS**. The followers of Dositheus, a Samaritan, contemporary with Jesus and the Apostles. According to Origen, he claimed to be the prophet mentioned in Deut. xviii. 18 and insisted on a curiously strict observance of the Sabbath. It is said that he starved to death in a cave. The early Christian writers often confused Dositheus with John the Baptist or with Simon Magus. There were Dositheans in Egypt as late as the sixth century, but the sect never attained importance.

**DOSITHEUS**, -at., from Gk. *Δωσιθεός*), called **MAGISTER**. A Greek grammarian and instructor of Roman students, belonging to the fourth century of the Christian era. He compiled a *Latin Grammar*, using the authorities employed by Charisius and Diomedes, and translated part of this into Greek. For his *Latin Grammar*, see Keil, *Grammatici Latini*, vol. vii (Leipzig, 1871). A work styled *Ἐμπνεύματα* ('Commentaries') was long erroneously attributed to him, because in some manuscripts it appeared in connection with his *Latin grammar*. Consult Krumbacher, *De Codicibus Quibus Interpretamenta Pseudo-dositheana Nobis Tradita Sunt* (Munich, 1883).

**DOSO DOSSI**, dōs'sō dōs'sē, GIOVANNI DI LUTERO (1474-1542). A celebrated Italian painter of the Renaissance, head of the Ferrarese school. He was assisted in many of his works by his brother **BATTISTA** (?-1548), whose work is difficult to distinguish from his. According to traditional authorities, on whose side is Berenson, they studied under Lorenzo Costa, but later critics usually name Panetti as their master. In their youth they are presumed to have visited Rome and Venice; for Giovanni shows the influence of the Venetian colorists, and Battista—the inferior of the two—that of Raphael. About 1512 the Dossi were working for the Gonzagas at Modena, and after 1514 they were employed by the dukes of Ferrara, where they decorated palaces, churches, and villas, designed cartoons for tapestries, and designed for porcelains. In 1531 they painted the frescoes in the Castello del Buon Consiglio in Trent. Aside from these facts little is known of the life of either. The poet Ariosto mentions them in *Orlando Furioso* with the highest praise. It now seems certain that many paintings hitherto attributed to Garofalo, Giorgione, and others are Giovanni's. As a colorist he ranks first among the Ferrarese painters, and his portraits may often be compared with Titian's. His subject pictures are also of great interest, for Dosso, along with a rich and glowing color, had a whimsical originality. The artificially pastoral spirit, of which the Italy of his day was full, appealed strongly to him, and the fantastic chivalry of the poetry of his friend Ariosto touched his imagination. One of his best pictures is "Circe in the Woods," in the Borghese

Gallery, a work full of romance and mystery; a second "Circe" is in the Benson collection, London. Other notable pictures by him are: "Madonna with St. Michael and St. George," in the Modena Gallery; "Holy Night," the portrait of Ercole D'Este, and five other pictures; "St. Sebastian," in the Brera at Milan; and a number of works in the Dresden Gallery, which has more of the Dossi pictures than any other European museum outside of Italy. "St. Hieronymus," in the Vienna Gallery, and the "Rest during the Flight into Egypt" (Palazzo Pitti), are among the works attributed to Battista alone. The landscapes in their pictures are often of great beauty and had much influence on the development of independent landscape painting, of which the brothers are said to have furnished an early example in the frescoes of the Villa Imperiale in Pesaro. Consult: Morelli, *Critical Studies of Italian Painters*, trans. by Ffoulkes, vol. ii (London, 1893); Zwanziger, *Dosso Dossi* (Leipzig, 1911); Mendelssohn, *Das Werck der Dossi* (Munich, 1913).

**DOST MOHAMMED KHAN**, dōst mō-hām'mēd kân (1793-1863). Ameer of Afghanistan from 1826 to 1863 and founder of the Barakzai dynasty. He was a son of Poyndah Khan, an able man, prominent in the civil and military life of Afghanistan. To avenge the assassination of his father, Futteh Khan, at the behest of the Ameer Mahmud, Dost Mohammed and two of his brothers headed a rebellion, confined Mahmud to the Province of Herat, and divided the remainder of the country. Discord arose between the brothers, and Dost Mohammed, in 1826, made himself master of the country. Meanwhile Runjeet Singh, the Sikh Rajah, had occupied Peshawar, and Shah Sujah, who had been driven from the throne in 1809, had sought English aid to restore him to power. Dost Mohammed attempted to win the friendship of the Anglo-Indian government; but that body rejected his advances and entered upon a costly course of blundering in regard to Afghan affairs. Captain Burnes was sent to Kabul in 1837, where the Ameer acknowledged frankly that, despairing of English support, he was looking towards Russia and Persia. At the same time he declared his wish to be on friendly terms with England. Meanwhile Lord Auckland, Governor-General of India, had adopted a policy of interference and now undertook to restore Shah Sujah. In 1839 an Anglo-Indian army invaded Afghanistan and occupied Kabul, Shah Sujah being nominally placed on the throne, and in 1840 Dost Mohammed delivered himself up to the British. Thereupon the Afghan tribes rose under Akbar, the son of the captive Ameer. In January, 1842, the British army left Kabul to return to India and was trapped in the Afghan defiles and annihilated. The advance of an army under General Pollock by way of the Khyber Pass enabled the British to recover from their defeat and overthrow Akbar; but Shah Sujah had been assassinated soon after the English left him at Kabul. In 1842 Dost Mohammed was allowed to return to his country and resume his interrupted reign. He assisted the Sikhs during their war with the British, but after the occupation of the Punjab he concluded a treaty with the Anglo-Indian government in 1855. In 1863 Dost Mohammed added to his dominions the Province of Herat, which had remained independent since the expulsion of Mohammed from Kabul. He died May 29, 1863, having directed that his son Shere

Ali (q.v.) should succeed him. Dost Mohammed had a certain rugged barbaric honesty not always found in Oriental princes. In spite of his hard experience with the government, he always leaned to the side in the frontier politics which involved Russia, Persia, Great Britain, and Afghanistan. He showed statesman-like qualities in external and internal affairs and brought a measure of order into the Afghan chaos. Consult Mohan Lal, *Life of the Amir Dost Mohammed, Khan of Kabul* (London, 1846). See AFGHANISTAN.

**DOSTOYEVSKY**, dōs'tō-yěv'skē, FRÉDOIR MIKHÁYLOVITCH (1821-81). A famous Russian novelist, the son of a Moscow physician. His home training was one of strict discipline and undue formalism. Reading early developed into a passion with him—a passion much favored by a lack of outdoor life and by the pedantic character of his home influence. In 1834 he entered a famous Moscow boarding school, from which he returned to his country home only during vacations, when he studied with great interest the peasant community in which he found himself. He was still an omnivorous reader, but his reading was gradually losing its desultory character. At 17 he entered the School of Engineering at St. Petersburg. On graduation he obtained a position in the Department of Engineers in 1843, but gave it up a year later for literary pursuits, making his début with *Poor People* (1846). A number of other sketches followed, and Dostoyevsky's head was full of literary plans and projects when, suddenly, a halt was called to them all. In 1849, for his connection with the revolutionary plot of Petrashevsky, he was condemned to death. On the scaffold, this sentence was commuted to hard labor in Siberia. During the years in prison he gave way to religious mysticism. Pardonned in 1855 by Alexander II, he resumed his literary activity at St. Petersburg, after five years' interruption, and remained hard at work till the end of his life. The first fruit of this renewed activity was *The Down-trodden and Oppressed*, his first long novel, published serially in the magazine *Vremya* ('The Times'), then newly founded and published in conjunction with his brother. This was followed by *Memoirs from a Dead House* (1861-62), wherein were related his own experiences in prison. He then became an ardent Slavophile and mystic, with a tendency towards absolutism, and his *Crime and Punishment* (1866) marked his break with the Liberals and Radicals. In his periodical, in his *Author's Diary*, in his *The Brothers Karamazov* (1879-80, unfinished), and other works, these new tendencies became more and more marked. The Liberals were almost reconciled with him after his famous speech at the banquet on the occasion of the unveiling of Pushkin's monument at Moscow in 1880.

His works are seriously deficient from the purely technical point of view, the language is rarely polished, and he lacks a sense of proportion. His power of psychological analysis, however, especially of pathological conditions, aided as he was in this by his complete self-identification with the lowly and degraded characters depicted, is unique in literature. The accuracy and the scientific value of his pictures are fully attested by great Russian criminologists. The last edition of his works, in six volumes, was published at St. Petersburg in 1904. English translations of the following works have appeared: *Crime and Punishment* (New York,

1886); *Poor Folk* (London, 1894); *Prison Life in Siberia* (ib., 1886); *The Idiot* (ib., 1887); *Uncle's Dream and The Permanent Husband* (ib., 1888); *The Brothers Karamazov* (New York, 1912); *Letters from the Underworld and Other Tales* (New York and London, "Everyman's Library," 1914). Consult: Brandes, *Dostoyevsky* (Berlin, 1889); Hoffmann, *F. M. Dostoyevsky* (ib., 1899); Koni, "Dostoyevsky criminaliste," in *Revue Internationale de Sociologie* (Paris, 1898); Phelps, "Dostoyevsky," in *Essays on Russian Novelists* (New York, 1912); Lloyd, *A Great Russian Realist* (New York, 1912); Merezhkovsky, "Tolstoi and Dostoyevski," in *Tolstoi, as Man and Artist* (ib., 1902).

**DOT**. See PEERYBINGLE, MRS.

**DOTARD** (so called from alleged stupidity). A name formerly applied by sailors to various Arctic seals, especially in Newfoundland, and to a young harbor seal (*Phoca vitulina*).

**DOTEN**, CARROLL WARREN (1871- ). An American statistician, born at Panton, Vt. He graduated in 1895 from the University of Vermont; taught there until 1903, meanwhile taking an M.A. at Harvard (1902); and was an instructor at Massachusetts Institute of Technology from 1903 to 1905, when he was made assistant professor of economics. He also directed the research work of the Boston School for Social Workers (1907-09) and served as expert special agent for the United States Census Bureau (1909). In 1906 he became secretary of the American Statistical Association and in 1910 chief investigator of the Massachusetts Commission on Compensation for Industrial Accidents. His publications include statistical papers, monographs, and reports such as *Recent Railroad Accidents in the United States*.

**DOTHAN**, dō'than. A city and the county seat of Houston Co., Ala., 119 miles by rail southeast of Montgomery, on the Atlantic Coast Line, the Central of Georgia, and the Atlanta and St. Andrews Bay railroads (Map: Alabama, D 4). It is an important commercial centre for that part of the State and has extensive compressed cotton and fertilizer interests, sash and door factories, and ice, cotton-oil, and lumber mills. It has several fine public buildings and a public library and owns its water works and electric plant. First settled about 1885, it was incorporated under a revised charter of 1901, is vested in a mayor, elected biennially, and a council of nine members. Pop., 1900, 3275; 1910, 7016.

**DOTHEBOYS** (dō'the-boiz) **HALL**. A Yorkshire school kept by one Squeers, in Dickens's *Nicholas Nickleby*, where Nicholas was assistant for a time—a picture of abuses in the country boarding-school system. The caricature was efficacious in causing the abolition of many similar educational horrors of Dickens's time.

**DOTONID**, dō-tō'nīd. A sea slug. See NUDIBRANCHIATA, and accompanying Colored Plate.

**DOTTEREL** (OE. *dotrelle*, little doll, from *dotien*, to be stupid, Dutch, *dutten*, Icel. *dotta*, to nod from sleep). A reddish plover (*Charadrius*, or *Pluvialis*), which in summer inhabits the northern parts of Europe and Asia, breeding chiefly in the highest latitudes, and migrates on the approach of winter to the countries around the Mediterranean and those of similar climate. It appears in Great Britain as a bird of passage, but is now almost extinct,



GERARD DOU

PORTRAIT OF HIMSELF. FROM THE PAINTING IN THE DUCAL MUSEUM, BRUNSWICK



owing to the incessant shooting of it in spring and the taking of its eggs.

**DOTTIN, HENRI GEORGES** (1863- ). A French Celtic scholar, born in Liancourt (Oise) and educated at the Laval Lycée, at Rennes, and at the Sorbonne. He taught at Dijon in 1891-92 and then at Rennes, where he was made professor of Greek in 1903 and dean of the faculty of letters in 1910. His article, "La littérature gaélique d'Irlande," in vol. iii of *Revue de Synthèse Historique*, contains a valuable bibliography; it has been translated and enlarged by Dunn, *The Gaelic Literature of Ireland* (1906). His publications include: *Glossaire des parlers du Bas-Maine* (1899); *Contes irlandais traduits du gaélique* (1901); *Contes et légendes d'Irlande traduits* (1901); *Manuel pour servir à l'étude de l'antiquité celtique* (1905); *Louis Eumius, mystère breton* (1911); *Manuel d'irlandais moyen* (1913). He edited the *Revue Celtique*.

**DO'TY, ALYAH HUNT.** An American physician. He graduated from the Bellevue Hospital Medical College (New York University) in 1878. He was health officer of the Port of New York until 1911, and he also lectured on quarantine sanitation at Bellevue. In 1913 he was appointed medical director for the Employees' Benefit Fund Committee of the American Telephone and Telegraph Company, the Western Union Telegraph Company, and the Western Electric Company. He is author of a *Manual of Instruction in the Principles of Prompt Aid to the Injured* (1889; 6th ed., 1913); *Prevention of Infectious Diseases* (1911); *The Mosquito: Its Relation to Disease and its Extirpation* (1912).

**DOU, DOW, or DOUW, GERRET (GERARD)** (1613-75). A Dutch genre painter. He was born at Leyden, April 7, 1613, and apprenticed first to an engraver and later to Pieter Kouwenhoven, a painter on glass; but his real master was Rembrandt, with whom he studied at Leyden, and to whom he was indebted for his skill in chiaroscuro. He first devoted himself to portrait painting, in which he achieved great success; good examples are his two portraits of himself in the Dresden Gallery and of Rembrandt's parents in Cassel. But genre subjects were better fitted to display his genius, and he excelled in simple domestic scenes, painted with infinite attention to detail. He would depict a broomstick or a pan of vegetables with as much carefulness as the figures that were introduced. It is said that he not only prepared his own brushes and pounded his colors, but worked with his own hands at everything required in the construction of a picture. Dou often painted with charming effect the artificial light produced by candle or lantern. His picture "The Evening School" (Rijks-Museum, Amsterdam) is the best example of candlelight effect. Along with the "Young Mother" (1658, Mauritshuis, Hague), it ranks among his very best works.

Other fine examples are the "Woman Sick of the Dropsy" (1663), "The Bible Reader," and the "Grocer Woman," in the Louvre; the "Girl at the Window," the "Schoolmaster," the "Hermit," and others, at Dresden; the so-called "Portrait of Dou's Wife" and the "Poulterer's Shop," in the National Gallery. He painted upward of 300 works and ranks as one of the most important Dutch genre painters, whose pictures were more sought after at home and abroad than any other of his day. His color

is soft and harmonious, his treatment of light and shade masterly, his draftsmanship (except during his last years) impeccable; but he is often tiresome in his excessive attention to detail. Among his pupils were Franz van Mieris, Gabriel Metsu, Van Slingeland, and Schalken; and the Leyden School of genre, which he founded, continued its activity until the middle of the nineteenth century. Consult: Van Dyke, *Old Dutch and Flemish Masters* (New York, 1895); Martin, *Gerard Douw* (Leyden, 1901; Eng. trans. by Bell, London, 1902 and 1908); also Martin, in *Klassiker der Kunst* (Stuttgart and Berlin, 1913).

**DOUAI, or DOUAY, dōw'ā.** A town of France, in the Department of Nord, situated on the river Scarpe, about 20 miles south of Lille. (Map: France N., J 2). Among the manufacturing establishments are salt and sugar refineries, ironworks, a cannon foundry, glass, bottle, and chemical works, breweries, and file factories, and there is an active trade in corn, seed, and linen. The town possesses a library of 96,000 volumes and a scientific and archaeological museum. There are many buildings dating back to the sixteenth and seventeenth centuries, and the church of Notre Dame was built in the twelfth century. Pop., 1901, 33,649; 1911, 36,314. It was held by the dukes of Burgundy after 1384, from whom it passed into the possession of the Hapsburgs. It was taken by Louis XIV in 1667, lost in 1710, and retaken in 1712. Douai was the seat of a celebrated seminary for English Catholics, founded by Cardinal Allen in 1568. It was formerly also the seat of a Catholic university. An English Benedictine seminary exists here. For the Douai Bible, see BIBLE.

**DOUARNENEZ, dōw'ar'ne-nēs' or -nēf** (Bret., Land of the Isle, alluding to the island of Tristan opposite). A seaport of Brittany, France, on a bay of the same name in the Department of Finistère. It has some shipbuilding, and its extensive sardine fisheries employ 4,000 men annually. Rope and net making is also carried on. Pop., 1901, 12,865; 1911, 13,753.

**DOUAY.** See DOUAI.

**DOUAY, FÉLIX CHARLES** (1816-79). A French general. He served in the wars in the Crimea, in Italy, and in Mexico, and for bravery at Magenta and Solferino he was made a brigadier general. In the Franco-German War he led the Seventh Army Corps, and he was taken prisoner at Sedan. As commander of the Fourth Army Corps, organized against the Communes, he was the first to enter Paris (May 22, 1871) and saved the Louvre from entire destruction.

**DOUBLE BASS.** The largest instrument of the violin family in common use. The double bass is the foundation of the orchestra, for to it is given the lowest part of the harmony. It probably received its name because it often doubles in the lower octave the bass of the harmony given to the bassoon, violoncello, or some other instrument. Not before the beginning of the nineteenth century were independent parts assigned to this instrument. It appears first about the beginning of the seventeenth century. Its origin is attributed to Gaspar di Salò in 1580, but he may have only added improvements to an instrument that already existed. The double bass was first used in the orchestra about 1696. It was originally mounted with three strings, but is now used with four strings

tuned in E<sub>1</sub>, A<sub>1</sub>, D, and G, and the notes sound an octave lower than written. Its compass is from E<sub>1</sub> to a. The double bass is an orchestral rather than solo instrument, but a few persons have excelled as virtuosi upon it, e.g., Dragonetti (q.v.), Bottesini (q.v.), and at the present day Kussewitzky (q.v.). The instrument is sometimes called a contrabass. Consult F. Warnecke, *Der Kontrabass: Seine Geschichte und Zukunft* (Hamburg, 1911). See BASS, and Plate of VIOLINS.

**DOUBLE COCONUT.** See SEYCHELLES COCONUT.

**DOUBLE CONSCIOUSNESS.** A morbid mental condition, also known as double personality, observed in cases of hysteria, hypnosis, and trance, characterized by the existence of two or more independent, self-consistent groups of conscious processes which alternate periodically or are called up in irregular sequence as favorable circumstances arise. Usually these groups are strictly separated from one another, so that, while the one group is in operation, the other is utterly shut out from consciousness—a fact which, from the purely psychological point of view, stamps the phenomenon as an instance of general derangement of memory. When the two sets of ideas become complex, and the mutual obliviscence is complete, each group develops that “aura” of sensations and feelings which constitutes selfhood; and the individual whose mind is thus partitioned may be rightly said to possess a “double” or “secondary personality.” When this division of mentation is radical, there is oftentimes exhibited a curious antithesis between the types of the two personalities—a condition popularly set forth, in an exaggerated degree, in Stevenson’s *Dr. Jekyll and Mr. Hyde*.

The ultimate basis of double consciousness must be sought in certain physiological conditions of the central nervous system. Partial light is thrown upon the conditions which favor the mental schism by the frequent demarcation of the two “selves” by specific antithetical moods. This feature makes it probable that the organic sensations, the chief determinants of our general mood or temper, may constitute the nucleus around which are gathered the remaining elements of the segregated “personality.” This function of the somatic elements of consciousness is well illustrated in Flournoy’s study of a remarkable case of divided consciousness, that of the medium “Mademoiselle Smith,” who “incarnates” several distinct personalities, and whose “guiding spirit” has his origin, in Flournoy’s judgment, in the sexual cœnæsthesis of the subject.

Prince, again, describes in detail a case in which there are three highly developed personalities besides several lesser ones. He concludes that the normal consciousness tends to break up into separate groups of processes, which may become completely dissociated from one another, and which tend under frequent recurrence to develop into independent personalities. His explanation, however, is couched, not in physiological terms, but in terms of a “subconscious” mental life, in which the several personalities are continuous and thus coexistent, though at a given time one alone rises to the rank of “primary consciousness,” i.e., the consciousness of which the “primary self” is aware. This concept of the subconscious or “co-conscious” is convenient for exposition, but throws

no light on the physiological principles to which we must go for our final explanation.

Finally, double consciousness may be regarded as, in a certain sense, merely an exaggeration of what is termed “motor automatism”—a condition which is often present, or at least easily developed, in the normal consciousness. Solomons and Stein have shown experimentally that there exists “a complete analogy between the performances of the second personality and the automatic acts of normal persons.” They were able, by practice, to cultivate automatisms of a complicated nature, such as spontaneous automatic writing and reading. If, e.g., A reads aloud to B, who simultaneously dictates to A, and the reading is sufficiently interesting, B will unconsciously dictate sentences which A unconsciously writes. It remains to be added that hypnosis furnishes excellent examples of the alternation of consciousnesses. Subjects who when awakened are totally ignorant of their hypnotic experiences, may in a succeeding hypnosis return without break to the consciousness of the former somnambulistic state. Consult: Flournoy, *From India to the Planet Mars* (New York, 1900); Kuelpe, *Outlines of Psychology*, trans. by Titchener (London, 1909); Wundt, *Lectures on Human and Animal Psychology*, trans. by Creighton and Titchener (ib., 1901); Dessir, *Das Doppel-Ich* (Leipzig, 1889); Janet, *L’Automatisme psychologique* (Paris, 1891); Prince, *The Dissociation of a Personality* (New York, 1906).

**DOUBLEDAY, ABNER** (1819–93). An American soldier. He was born at Ballston Spa, N. Y. At Cooperstown, N. Y., in 1839 he helped draw up the first baseball rules in the United States. He graduated at West Point and was assigned as brevet second lieutenant of artillery in 1842. He served in the First Artillery during the Mexican War and participated in the battles of Monterey and Buena Vista. He was stationed at Fort Moultrie at the breaking out of the Civil War and took part in the defense of Fort Sumter. A month later he was promoted major and served with General Patterson in the Shenandoah valley, and on Feb. 3, 1862, he was made a brigadier general of volunteers and placed in command of the defenses of Washington. He commanded a division at the battle of Bull Run and at Antietam. He became a major general of volunteers in November, 1862; fought at Fredericksburg, Chancellorsville, and at Gettysburg, where on the first day of the battle, when General Reynolds fell, he commanded the troops in the field for several hours. He continued to serve (as colonel in the Thirty-fifth Infantry) in the regular army after the war, but retired in 1873. He published *Reminiscences of Forts Sumter and Moultrie in 1860–61* (1876), and *Chancellorsville and Gettysburg* (1882) in the “Centennial of the Civil War Series.”

**DOUBLEDAY, FRANK NELSON** (1862– ). An American publisher, born in Brooklyn, N. Y., and educated at Brooklyn Polytechnic Institute. He was connected with Charles Scribner’s Sons from 1877 to 1895, during which time he re-founded and edited *The Book Buyer* (1884) and served as manager of *Scribner’s Magazine* after it was established in 1886. From 1897 to 1900 he was a member of the publishing house of Doubleday & McClure Co., and he then became president of Doubleday, Page & Co., publishers of *Country Life in America*, *The World’s Work*,



*The Garden Magazine*, and *Farming*, and of books in all departments of literature.

**DOUBLEDAY**, NELTJE DEGRAFF ("NELTJE BLANCHAN") (1865- ). An American writer on nature, born in Chicago. She married Frank Nelson Doubleday in 1886. In addition to pamphlets and ... articles she is author of: *The Pie* ... (1894); *Bird Neighbors* (1897; 4th ed., 1904); *Birds that Hunt and Are Hunted* (1898; 3d ed., 1905); *Our Wild Flowers and their Insect Visitors* (1900); *How to Attract the Birds* (1902); *Birds Every Child Should Know* (1907); *The American Flower Garden* (1909; 2d ed., 1913).

**DOUBLE DRAGON**, ORDER OF THE. A Chinese military order with five grades. It was established in 1865 for the purpose of rewarding European officers who had been of service to China, but was extended to other classes in 1882. See Plate II of ORDERS.

**DOUBLE EYE**, or FOUR-EYES. See ANA-BLEPS.

**DOUBLE FERTILIZATION**. See FERTILIZATION.

**DOUBLE FLOWER**. See FLOWER.

**DOUBLE MARRIAGE**, THE. A tragedy by Fletcher and Massinger (1619), printed in 1847.

**DOUBLE PERSONALITY**. See DOUBLE CONSCIOUSNESS.

**DOUBLE REFRACTION**. See LIGHT.

**DOUBLE STARS**. As seen by the naked eye, all stars appear to be single, but the telescope shows us that many are double, while it resolves others into several distinct bodies. In some instances telescopes of low power suffice to reveal the separation; others require instruments of the largest kind. It is not possible to decide by a single observation whether these stars are "optical" doubles, of which the two components are merely projected upon contiguous points of the sky, or true "binary" systems, whose components are really near each other in space. But if the lapse of time reveals to observers an orbital motion of the components, it is safe to assume that we have to deal with a pair of stars physically connected—a double star, as it were. About 15,000 double stars are known, and of these some 700 are almost certainly binary. Their periods of revolution range from five and a half years up to perhaps 10 centuries.

In addition to these optical doubles and binary systems observed visually with the telescope, astronomers have discovered a number of so-called "spectroscopic" binaries. These have an orbital revolution which is often extremely short, and the components are so near together that they cannot be separated in the ordinary way by the most powerful telescopes. But a study of their spectra reveals a duplication of the spectral lines, explicable only on the theory that we have to do with a double source of light. Periodicity in this duplication then allows the observational determination of the time of orbital revolution in the double system. See STAR.

**DOUBLET** (from *double*; cf. OF. *doublier*, *doublour*, lining of a garment; so called from being originally lined or wadded for defense). A close, tight-fitting garment with or without sleeves, reaching a little below the girdle. It was almost identical with what was afterward called the jerkin, which, as a matter of strict chronology, belongs rather to the sixteenth and seventeenth centuries. The sleeves were sometimes detachable, being tied on the arms. In

its various forms the doublet was the forerunner of the modern coat, jacket, and waistcoat. See COSTUME.

**DOUBLET**. An imitation gem, usually made by cementing a thin layer of a genuine gem by means of a colorless gum, such as mastic, on the line of the girdle, to a piece of glass that has been colored to imitate the real gem. See GEMS, IMITATION AND ARTIFICIAL.

**DOUBS**, dōō (ancient, *Dubis*). An eastern department of France, separated from Switzerland by the Jura Mountains (Map: France, N., M 5). Area, 2030 square miles. Pop., 1901, 298,864; 1911, 299,935. Doubs is traversed by the river Doubs (highest point Mont Dore, 4800 feet), a tributary of the Saône, the Des-soubre and the Loue. The surface is hilly, being crossed by four parallel ranges of the Jura Mountains. The climate is more rigorous than in most similar latitudes of Europe. Pine, walnut, and common orchard trees thrive well; mines of iron and coal are worked; and gypsum, building stone, lime, and marble are abundant. The trade is principally in iron, cattle, horses, and dairy products. It is famous for its cheese. Capital, Besançon. The department was formed out of part of the old Franche-Comté.

**DOUBTING CASTLE**. In Bunyan's *Pilgrim's Progress*, the dwelling of Giant Despair.

**DOUBTING INSANITY**. A form of melancholia (q.v.).

**DOUC**, dōōk (Fr. *douc*, of uncertain etymology). A small monkey (*Semnopithecus*, or *Pygathrix nemaus*) of Cochín-China, curiously variegated with black, white, and red. It is a little more related to the hanuman (q.v.).

**DOUCET**, dōō'sá', CHARLES CAMILLE (1812-95). A French dramatist, born in Paris. He wrote *Léonce* (1838) in collaboration with Bayard, and the play was followed by several comedies in verse. These have been collected and published under the title *Comédies en vers* (1858). The most successful of his plays was *La considération* (1860). He was elected a member of the Academy in 1865. His *Œuvres complètes* were published in 1874.

**DOUCET**, HENRI LUCIEN (1856-95). A French figure and portrait painter. He was born in Paris, studied there under Lefebvre and Boulanger, and in 1880 won the Prix de Rome. His pictures are usually piquant, sparkling representations of modern life, eminently Parisian in style, but the audacious realism of his earlier work is not maintained in his later, which is somewhat characterless. His portraits in pastel also are notable. His most widely known picture is "Après le bal" ('After the Ball,' 1889). Other excellent examples are the portraits of Madame Galli-Marie as "Carmen" (1884, Marseilles Museum), the Princesse Mathilde and "My Parents" (1890, Lyons Museum); "A Spanish Woman" (Pontoise Museum), and a "Nude Figure" (1890). He was awarded a first-class medal for pastel in 1889 and the decoration of the Legion of Honor in 1891.

**DOUCHE**. dōōsh. See BATH; HYDROTHERAPY.

**DOUGALL**, dōō'gal, LILY (1858- ). A Canadian novelist, born in Montreal. She completed her education at the universities of Edinburgh and St. Andrews and passed much of her time at Melbourne, in Derbyshire, England. The scope of her work extends from Canadian themes to a portrait of the new woman. Among her popular novels are: *Beggars All* (1891);

*What Necessity Knows* (1893); *The Mermaid* (1895); *Zeitgeist* (1895); *Question of Faith* (1895); *The Madonna of a Day* (1896); *A Dozen Ways of Love* (1897); *The Mormon Prophet* (1898); *The Earthly Purgatory* (1904); *The Spanish Dowry* (1906); *Paths of the Righteous* (1908).

**DOUGH BIRD.** See CURLEW.

**DOUGHFACE.** A contemptuous nickname applied before the Civil War to any Northern man who was accused of truckling to the slave power. Lowell explains the term in his glossary to the *Biglow Papers* as meaning "a contented lickspittle, a common variety of Northern politicians," and makes his "pious editor" say:

"For any office, small or gret,  
I couldn't ax with no face,  
'thout I'd ben, thru dry an' wet,  
Th' unrizzest kind o' doughface."

*Works*, viii, 102.

The term was probably first used in this connection by John Randolph, of Roanoke, who in 1820 referred to the eighteen Northern Congressmen who had supported the Missouri Compromise as "Northern Doughfaces."

**DOUGHTY**, do'ti or do'ti, ARTHUR GEORGE (1860- ). A Canadian historian and archivist. He was born at Maidenhead, England, and was educated at New Inn Hall (later part of Balliol College), Oxford, and Dickenson College, Carlisle. He afterward prepared to enter the church, and was associated with All Hallows' Mission, Southwark, London; but later he came to Montreal to engage in commercial pursuits and was a music and dramatic critic for newspapers and . . . . 1901-04 he was joint librarian . . . . Legislature, and in the latter year was appointed Dominion archivist and keeper of the records. He was created a C.M.G. in 1905. In 1912 he was appointed a deputy minister. His principal publications are: *The Life and Work of Tennyson* (1893); *The Siege of Quebec*, with G. W. Parmelee (2 vols., 1901-02); *Quebec under Two Flags*, with N. E. Dionne (1903); . . . . for *Supremacy* (1905); *Documents . . . . the Constitutional History of Canada*, with Adam Shortt (1907); *The Cradle of New France* (1908); *Index and Dictionary of Canadian History*, with L. J. Burpee (1911). In 1912 he and Adam Shortt became general editors of a projected work in 22 volumes entitled *Canada and its Provinces: A History*. In 1913 several volumes had been published.

**DOUGHTY**, CHARLES MONTAGUE (1843- ). An English explorer. He was born at Theberton Hall, Suffolk, and was educated at Cambridge. During a sojourn of two years in Arabia he made a valuable study of the geography, archaeology, and ethnography of the country, the results of which were afterward embodied in the work entitled *Travels in Arabia Deserta* (1888). He received the Royal medal of the Royal Geographical Society in 1912. His writings include: *Documents epigraphiques* (1884); *The Dawn of Britain* (6 vols., 1906); *Adam Cast Forth* (1908); *The Cliffs* (1909); *The Clouds* (1912).

**DOUGHTY**, THOMAS (1793-1856). An American landscape painter, born in Philadelphia, Pa. He had hardly any instruction in art and was 30 years old when he took up painting as a profession. A highly successful exhibition of paintings in Boston in 1831 gave him a national reputation and enabled him to travel

abroad; but later he suffered greatly through lack of appreciation. Doughty was the precursor of the Hudson River school. Although his works now possess chiefly a historic interest, their fidelity to nature, luminous, silvery tone, and wide perspective give them undoubted poetic charm. They are, moreover, entirely independent of foreign models. Among his best paintings are: "A View of the Schuylkill" (Edinburgh Museum); five works in the Pennsylvania Academy of Fine Arts, Philadelphia; "On the Hudson" and "A River Glimpse" (Metropolitan Museum, New York).

**DOUGLAS**, dū'glas (Ir. *Dubh-ghlaise*, black stream). The capital and principal seaport of the Isle of Man, situated on the margin of a highly picturesque bay on the east side of the island (Map: England, B 2). It has become an important . . . . e. The old town, standing on the . . . . edge of the bay, with narrow, tortuous streets, has mostly given way to the handsome modern terraces and villas which occupy the rising ground beyond. A fine promenade skirts the edge of the bay. The Tower of Refuge, a castle-like structure, occupies a dangerous rock in the southern area of the bay, called Conister, and was erected in 1833 for the safety of shipwrecked mariners. Douglas was incorporated in 1895, and since that date much has been done by the authorities to promote the prosperity of the town. The water supply has been municipalized; many improvements in streets, promenades, etc., have been carried out; new municipal buildings and artisans' dwellings have been erected. The tramways were acquired by the municipality in 1902, and in 1906 an elaborate public-bathing service was established. The town maintains a public library, markets, and . . . . Douglas is the principal packer . . . island and is in steamship communication with Liverpool, Belfast, Dublin, and Glasgow. Pop., 1901, 19,223; 1911, 21,101.

**DOUGLAS**. A city in Cochise Co., Ariz., 33 miles southeast of Bisbee, on the El Paso and Southwestern Railroad, and the terminus of the Nacozari Railroad of Mexico (Map: Arizona, F 6). It contains two of the largest copper smelters in the United States, gypsum, cement, and plaster works, and a brewery. Two miles distant from the city, on the Mexican side, is the battlefield of Agua Prieta. The water works are owned by the municipality. Pop., 1910, 6437.

**DOUGLAS**. A city and the county seat of Coffee Co., Ga., 43 miles northwest of Waycross, on the Atlanta, Birmingham, and Atlantic, and the Georgia and Florida railroads (Map: Georgia, D 4). It contains an agricultural college and a normal school. There are cotton gins, an oil mill, saw and grist mills, novelty works, and a turpentine and rosin factory. The city owns its water works and electric-light plant. Pop., 1900, 617; 1910, 3550.

**DOUGLAS**. A family of great prominence in the history of Scotland. The legend of the sixteenth or seventeenth century, attributing its rise to the bravery of Sholto Douglas in 770, is impossible from the details of the legend itself. Nor can any connection be traced, as Chalmers supposed there could be, between the Douglasses and the Fleming Theobald, who held the lands on Douglas water from 1147 to 1164.

WILLIAM OF DOUGLAS appears as a witness

of charters in 1175 and 1213. He was doubtless so called from the vale of Douglas, in Lanark, which he held. His son Bruce was made Bishop of Murray in 1203.—**SIR ARCHIBALD**, or **ERKENBALD**, of **DOUGLAS**, who appears in charters between 1190 and 1232, was the first of the family to attain the rank of knighthood. Besides the family inheritance he held land under the monks of Dunfermline and the Earl of Fife, and in Clydesdale through his wife, one of the heiresses of Sir John Crawford. His son, **SIR WILLIAM**, figures in charters from 1240 to 1273, and appears in 1255 as a Scottish partisan of Henry III of England in the baronial wars and was granted the manor of Faudon in Northumberland by the future Edward I. His son, **SIR HUGH**, died in 1287, and was succeeded by his brother, **WILLIAM THE HARDY**, as he is called in family traditions, a daring and restless man. He was the first man of influence to join Wallace in his rising against the English, but soon deserted him, submitting to his old patron, King Edward I, to whom he had again and again sworn fealty. He was sent prisoner to the Tower of London, where he died in 1298. It appears that he possessed lands in one English and in seven Scottish counties—Northumberland, Berwick, Edinburgh, Fife, Lanark, Ayr, Dumfries, and Wigton.

The history of his son, the **GOOD SIR JAMES OF DOUGLAS**, is familiar to every one, as Bruce's greatest captain in the long War of the Succession. The hero of 70 fights, he is said to have won them all but 13, leaving the name of the "Black Douglas"—so he was called from his swarthy complexion—as a word of fear by which English mothers stilled their children. He was slain in Andalusia, in 1330, on his way to the Holy Land with the heart of his royal master, and was succeeded by his son, **WILLIAM, LORD OF DOUGLAS**, who was slain at Halidon in 1333.—**SIR ARCHIBALD L. DOUGLAS** (1296–1333), a younger brother of the Good Sir James, was a prominent Scottish leader during the minority of David II. In 1332 he surprised and defeated Edward de Baliol, the rival claimant of the throne. He was made Regent of Scotland in 1333 and in the same year invaded England, but was defeated and slain at Halidon. In 1357 **SIR WILLIAM OF DOUGLAS**, son of the Regent of Scotland, who had fought at Poitiers and . . . himself in other fields, was made . . . uglas and afterward, by marriage, became Earl of Mar. In 1371 he even disputed the succession of the Scottish crown with Robert II, the first of the Stuarts, which he claimed as a descendant of the Baliols and Comyns. His pretensions were abandoned only on condition that his son should marry the King's daughter. He died in 1384. His son, **JAMES**, second Earl of Douglas and Mar, the conqueror of Hotspur (q.v.), fell at Otterburn in 1388; and, as he left no legitimate issue, the direct male line of William the Hardy and the Good Sir James now came to an end.

The Earldom of Douglas, meanwhile, was bestowed on an illegitimate son of the Good Sir James—**ARCHIBALD**, Lord of Galloway, surnamed the Grim. By his marriage with the heiress of Bothwell he added that barony to the Douglas domains; and, having married his only daughter to the heir apparent of the Scottish crown, and his eldest son to the eldest daughter of the Scottish King, he died in 1400 or 1401. His son and successor, **ARCHIBALD**, fourth Earl of Douglas,

was, from his many misfortunes in battle, surnamed "the Tyneman"—i.e., the loser. He was taken prisoner at Homildon (1402), and at Shrewsbury in the following year. Repairing to France, he was there made Duke of Touraine, and fell at Verneuil in 1424. He was succeeded by his son **ARCHIBALD**, who distinguished himself in the French wars and, dying in 1439, was buried in the church of Douglas, where his tomb still remains. His son and successor, **WILLIAM**, a boy of 16, by the splendor of his court aroused the fear of the Scottish King, and was treacherously beheaded in Edinburgh Castle in 1440. His French duchy and county died with him; his Scottish earldom was bestowed on his grand-uncle (the second son of Archibald the Grim), **JAMES**, surnamed the Gross, who in 1437 had been made Earl of Avondale. He died in 1443, being succeeded by his son **WILLIAM**, who, by marriage with his kinswoman (the only daughter of Archibald, fifth Earl of Douglas, and second Duke of Touraine), again added the lordship of Galloway to the Douglas possessions. He was for a time all-powerful with King James II, who made him lieutenant general of the realm; but, afterward losing the royal favor, he seems to have entered into a confederacy against the King, by whom he was killed in Stirling Castle in 1452. Leaving no child, he was succeeded by his brother **JAMES**, who in 1454 made open war against King James II as the murderer of his brother and kinsman (the sixth and eighth Earls of Douglas). The issue seemed doubtful for a time; but, the Hamiltons and others being gained over to the King's side, Douglas fled to England. The struggle was still maintained by his brothers—**Archibald**, who by marriage had become Earl of Murray, and **Hugh**, who in 1445 had been made Earl of Ormond. They were defeated at Arkinholm in May, 1455, Murray being slain on the field and Ormond taken prisoner and afterward beheaded. Abercorn, Douglas, Strathaven, Thrieve, and other castles of the Douglasses, were dismantled, and the Earldom of Douglas came to an end by forfeiture, after an existence of 98 years, during which it had been held by no fewer than nine lords. The last Earl lived many years in England, where he had a pension from the crown and was made a knight of the Garter. In 1484 he leagued himself with the exiled Duke of Albany to invade Scotland. He was defeated at Lochmaben, but James III spared his life on condition of his taking the cowl. He died in the abbey of Lindores in April, 1488; and so ended the elder illegitimate line of the Douglasses.

**Earls of Angus.** This line was begun with **GEORGE**, the illegitimate son of William, first Earl of Douglas, and Margaret Stewart, Countess of Angus and Mar. He received a grant of his mother's Earldom of Angus in 1389, married in 1397 the youngest daughter of King Robert II, was taken prisoner at Homildon in 1402, and died of the plague in England in the following year. He was succeeded by his son, **WILLIAM**, who, dying in 1437, was succeeded by his son **JAMES**, who died without issue, when the title reverted to his uncle, **GEORGE**, fourth Earl of Angus, took part with the King against the Douglasses in 1454: his loyalty was rewarded by a grant of their old inheritance of Douglasdale; and so, in the phrase of the time, "the Red Douglas"—such was the complexion of Angus—"put down the Black." He died in 1462, being succeeded by his son **ARCHIBALD**, surnamed Bell-

the-Cat, and sometimes also called the Great Earl. After filling the highest offices in the state and adding largely to the family possessions, he retired to the priory of Canons Regular at Whithorn, in Galloway, where he died about 1514. He was succeeded by his grandson ARCHIBALD, who in 1514 married the Queen Dowager of Scotland, Margaret, sister of Henry VIII of England and widow of James IV of Scotland. The fruit of this marriage was a daughter, Margaret, who, marrying the Earl of Lennox, became the mother of Henry, Lord Darnley, the husband of Queen Mary and father of King James VI. The Earl of Angus had for a time supreme power in Scotland; but in 1528 the young King James V escaped from his hands, and sentence of forfeiture was passed against Angus and his kinsmen. The King swore that while he lived the Douglasses should have no place in his kingdom, and he kept his vow. On his death, in 1542, Angus returned to Scotland and was restored to his honors and possessions. He died at Tantallon in 1556. His nephew, who succeeded him, died two years afterward, leaving an only son, ARCHIBALD, eighth Earl of Angus. This Good Earl, as he was called, died in 1588, when his title devolved on his kinsman WILLIAM, the grandson of Sir William Douglas of Glenbervie, second son of Archibald Bell-the-Cat. Dying in 1591, he was succeeded by his son WILLIAM, who next year obtained from the crown a special recognition of his high privileges as Earl of Angus. He turned Roman Catholic, and died in Paris in 1611.

**Marquises and Dukes of Douglas, and Lords Douglas.** WILLIAM, eleventh Earl of Angus, was created Marquis of Douglas in 1633 and, dying in 1660, was succeeded by his grandson JAMES, who died in 1700, leaving issue one son and one daughter. The son, ARCHIBALD, third Marquis of Douglas, was created Duke of Douglas in 1703 and died childless in 1761, when his dukedom became extinct and his marquissate devolved on the Duke of Hamilton. The descendants of the sister, Lady Jane Douglas, were British peers, under the title Baron Douglas of Douglas Castle, from 1790 till 1857. The claims of the rivals to the Earldom of Angus in 1762 were never decided, and the title is still in abeyance. The right attached to it of bearing the crown of Scotland was debated before the Privy Council in 1823, when it was ruled that Lord Douglas's claim to that honor, being a claim of heritable right, fell for decision to a court of law. The motto of the Douglas arms, *Jamais arriere* ('Never behind'), probably alludes to the peculiar precedence inherent in their Earldom of Angus. The bloody heart commemorates Bruce's dying bequest to the Good Sir James; the three stars which the Douglasses bear in common with the Murrays seem to denote the descent of both from one ancestor.

**Earls of Morton.** SIR ANDREW OF DOUGLAS, who appears in record in 1248, was apparently a younger son of Sir Archibald, or Erkenbald, of Douglas, the second chief of the house. His son, WILLIAM OF DOUGLAS, swore fealty to King Edward I for his lands in West Lothian in 1296 and was probably the father of Sir James of Douglas—surnamed the Lothian, to distinguish him from his kinsman of Clydesdale—who in 1315 had a grant from Bruce of the lands of Kincavil and Calder-clere. He died about 1320, being succeeded by his son, SIR WILLIAM OF

DOUGLAS, of Liddesdale, who greatly enlarged the family possessions in Fife and elsewhere. The "Knight of Liddesdale"—as he was called by his contemporaries, who regarded him as "the flower of chivalry"—was assassinated in 1353 by his kinsman, William, first Earl of Douglas, to revenge his wife's dishonor. He was succeeded by his nephew, SIR JAMES OF DOUGLAS, of Dalkeith, a man of literary tastes, who entertained Froissart at his board and possessed a valuable library for the day. He was of great power and influence, and contracted princely alliances. His first wife was a daughter of "Black Agnes," the heroic Countess of Dunbar; his second was a sister of King Robert II; and he matched his eldest son, Sir James of Douglas, of Dalkeith, with a daughter of King Robert III. Their grandson married a daughter of King James I and in 1458 was created Earl of Morton. His grandson, the third Earl, dying without male issue in 1553, the earldom devolved on his daughter's husband, the Regent Morton, JAMES DOUGLAS, great-grandson of Archibald Bell-the-Cat. (See MORTON, JAMES DOUGLAS.) After his fall the title went to ARCHIBALD, eighth Earl of Angus; and when he died childless, in 1588, it passed to SIR WILLIAM DOUGLAS, of Lochleven, who thus became seventh Earl of Morton. His losses in the great Civil War compelled him, in 1642, to sell Dalkeith to the Earl of Buccleuch, and his Tweeddale and Eskdale lands to others; but Aberdour and other old domains of the family still remain with his descendant, the Earl of Morton, who descends legitimately in the male line from William of Douglas, the progenitor of the race in the twelfth century.

**Other Branches.** In the seventeenth century the descendants of Sir William Douglas of Drumlanrig, an illegitimate son of the hero of Otterburn, were created earls, marquises, and dukes of Queensberry, earls of March, and earls of Solway, of which titles only that of the Marquis of Queensberry remains in the family. During the same period younger branches of the family were earls of Selkirk, Forfar, and Dumbarton, and held other titles, of which that of the Earl of Selkirk is the only one not now dormant or extinct.

**Bibliography.** Hume of Godscroft, *A History of the House of Douglas and Angus* (Edinburgh, 1644; reprinted 1748), preserves the traditions of the family, but its accuracy is not to be trusted. The earlier history of the Douglasses has been critically examined by Chalmers in his *Caledonia*, vol. i (London, 1807); by Riddell in his *Remarks upon Scotch Peerage Law* (Edinburgh, 1833); by Cosmo Innes, in the *Registrum Episcopatus Moraviensis* (ib., 1837), and the *Liber S. Marie de Calchou*, vol. i (ib., 1846); and by Joseph Robertson, in the *Origines Parochiales Scotiæ*, vol. i (ib., 1851). The descent of the houses of Angus and Dalkeith was first ascertained by Riddell in his *Remarks upon Scotch Peerage Law*, pp. 154-164 (ib., 1833), and in his *Stewartiana*. The charters and correspondence of the Morton family have been edited for the Bannatyne Club by Mr. Cosmo Innes, in the *Registrum Honoris de Morton* (ib., 1853). Consult Maxwell, *A History of the House of Douglas* (London, 1902). This book contains an extensive bibliography on the Douglas family.

**DOUGLAS, SIR ARCHIBALD LUCIUS (1842-1913).** A British admiral, born at Quebec, Canada, and educated at the Quebec high school.

Having in 1856 joined the *Boscawen*, the flagship of the North American and West Indian stations, he became a lieutenant (1861), commander (1872), captain (1880), and vice admiral (1901). He served with the naval brigade that went up the Congo and the Gambia in 1860; in 1873-75 he was director of the Japanese Imperial Naval College. At various times he commanded the *Serapis* (Soudan, 1884), the *Edinburgh*, the *Cambridge*, and the *Excellent*; and he was commander in chief in the East Indies (1898-99), at the North American and West Indian stations (1902-04), and at Portsmouth, England (1904-07). From 1896 to 1898 he served as vice president of the ordnance committee, and from 1899 to 1902 he was Lord of the Admiralty. He retired in 1907. In 1893-95 he was aid-de-camp to Queen Victoria, he was created G.C.V.O. in 1905 and G.C.B. in 1911, and he received also several foreign decorations.

**DOUGLAS, SIR CHARLES WHITTINGHAM HORSLEY** (1850-1914). A British soldier. In 1869 he joined the Ninety-second Regiment, with whom he served during the Boer War (1879-80). In the following year he took part in the Boer War, in 1884 he acted as quartermaster-general in the Suakim expedition, and after home service at Aldershot (1893-98) he was actively engaged in the South African War. At its close he was promoted major general. Returning to England, he commanded the First Infantry Brigade (1901), the Second Division of the First Army Corps (1902-04), and the Chief Southern Command (1909-12). He was second military member of the Army Council and adjutant general of the forces in 1904-09 and inspector general from 1912 to 1914. In the latter year he was further promoted, being appointed Chief of the Imperial General staff, succeeding Field Marshal Sir J. D. P. French at the time of the Ulster crisis. (See *IRELAND, History*.) General Douglas was created G.C.B. in 1911.

**DOUGLAS, DAVID** (1798-1834). A Scottish botanist and traveler, born at Scone, Perthshire. He visited the United States in behalf of the Royal Horticultural Society in 1823. In his capacity as a collector he set out on a tour to the Pacific in 1824 and in the following year reached Fort Vancouver. It was on this scientifically fruitful journey that he discovered *Pseudotsuga douglasii*, the well-known "Douglas spruce." Although the name of the species should probably be *P. mucronata*, the common name will always commemorate Douglas. After another sojourn of five years in California and British Columbia he visited the Sandwich Islands in 1834, where he died from wounds inflicted by an infuriated bull. He introduced into botany more than 150 specimens of trees and plants indigenous to America.

**DOUGLAS, ELLEN.** A character in Scott's *Lady of the Lake*.

**DOUGLAS, GAWIN or GAVIN** (c.1474-1522). A Scottish poet, the third son of Archibald, fifth Earl of Angus. He was educated at St. Andrews for the church and was early appointed to Prestonkirk, near Dunbar. In 1501 he was made provost of St. Giles, Edinburgh. From the marriage of his nephew, the sixth Earl of Angus, to the widowed queen of James IV, Douglas expected rapid preferment; but the jealousy of the nobility and the Regent Albany was such that Douglas, who had, through the

influence of the Queen, obtained the bishopric of Dunkeld directly from the Pope (January, 1515), was tried before the Scottish peers, found guilty of conspiring against the privileges of the crown, and condemned to imprisonment. He was set at liberty in about a year and inducted into his bishopric. Owing to his nephew's ill-treatment of the Queen, who thereupon joined with the Regent against the Douglas, he was deprived of his bishopric (1520). He went to England to obtain the aid of Henry VIII, but accomplished nothing, and died suddenly of the plague in London. His poems belong mostly to his early life. They comprise two allegories, entitled *The Palace of Honour* and *King Hart*, and a translation of Vergil's *Aeneid* into Scottish verse. There is, besides, a minor poem on *Conscience*. To each book of the *Aeneid* is prefixed a description of Scottish scenery, and the translation, finished in 1513, is the first complete rendering of a long Latin classic into English. In his original poems Douglas carried on the tradition of Chaucer. His allegories are beautiful, and his landscapes surpass any others in our early poetry. His *Works*, edited, with a memoir, by Small, were published in four volumes (Edinburgh, 1874). Consult J. H. Millar, *Literary History of Scotland* (London, 1903), and *Cambridge History of English Literature*, vol. ii (Cambridge and New York, 1907-13).

**DOUGLAS, GEORGE.** The temporary keeper of Lochleven Castle, in Scott's *Abbot*. He falls in love with Mary, Queen of Scots, helps her to escape, and is killed in the battle of Langside.

**DOUGLAS, GEORGE** (1825-94). A Canadian clergyman, born at Ashkirk, Scotland. As a boy, he was brought by his parents to Montreal, Canada, was apprenticed to a blacksmith, and later was clerk in a bookstore. He started to study medicine, but, having decided to be a Methodist minister, he went to England in 1849 to finish his training at the Wesleyan Theological College. Thence he was at once sent as a missionary to the Bahamas. Ordained to the ministry in 1850, he went to Bermuda, where he remained a year and a half and contracted an illness from which he never fully recovered. During the nine years following his return to Canada he filled pastorates in Kingston, Toronto, and Hamilton. His preaching was remarkable for an ornate and stately eloquence which gave him rank as one of the greatest pulpit orators of Canada. He filled the highest administrative offices of his church, and was for seven years president of the Wesleyan Theological College at Montreal. In 1869 McGill University conferred upon him the degree of LL.D.

**DOUGLAS, GEORGE WILLIAM** (1850- ). An American clergyman, born in New York City. He graduated from Trinity College (Conn.) in 1871 and from General Theological Seminary and studied also at Oxford and Bonn, and, being ordained a priest in the Protestant Episcopal church (1878), thereafter until 1898 had charges in New York, Washington, and New Haven. He was select preacher for Grace Church, New York, and an instructor in the Training School for Deaconesses from 1898 to 1904, when he became examining chaplain for the diocese of New York and senior canon of the cathedral of St. John the Divine. His writings include: *Hints to Sunday School*

*Teachers* (1883); *Prayers for Children* (1884); *Sermons Preached in St. John's Church, Washington* (1893); *The Many-Sided Roosevelt* (1907); *Essays in Appreciation* (1912; enlarged, 1913).

**DOUGLAS, SIR HOWARD, BART.** (1776-1861), son of Admiral Sir Charles Douglas. An English general and author of important military and naval treatises, born at Gosport. After serving in Spain and Portugal he was appointed Governor of New Brunswick (1823-31) and Lord High Commissioner of the Ionian Islands (1835-40) and elected member of Parliament for Liverpool (1842-47). He was made general in the army in 1851, and colonel of the Fifteenth Infantry Regiment. He died at Tunbridge Wells. His best-known work is *Military Bridges and the Passage of Rivers* (London, 1816), an essay which, it is claimed, suggested the suspension bridge. His treatise on *Naval Gunnery* (1820) was regarded as authoritative in several countries.

**DOUGLAS, JAMES.** See MORTON, JAMES DOUGLAS, fourth EARL OF.

**DOUGLAS, SIR JAMES** (1803-77). A Canadian administrator and the chief founder of British Columbia. He was born in Demerara, British Guiana, but in early youth was taken to Scotland, where he was educated in a private school at Lanark. When 16 years old he came to Upper Canada and was employed at Fort William by the Northwest Company, the rival of the Hudson's Bay Company in the fur trade. Upon their meeting in 1821 he was sent into the Hudson's Bay Company's territory west of the Rocky Mountains and known as the Columbia Department. In 1824 he was transferred to New Caledonia, the nucleus of British Columbia. In that department his qualifications as accountant, explorer, trader, and organizer, enhanced by his dependable character, gained the confidence of the company and made him especially valuable in the establishment and oversight of new posts. In 1830 he was sent to Fort Vancouver, Oregon Territory, where, as coadjutor to the chief factor, John M. Douglas, he shared the weighty responsibility of carrying out a policy of expansion which promised dramatic results. During 1830-46 the company's forts were built northward towards Alaska, southward towards California, and also into the interior of Oregon; but the hopes founded on these successes were not realized. In 1842 Douglas, who foresaw that the incoming tide of settlement would destroy the fur monopoly in the region immediately tributary to Fort Vancouver, decided that an Indian village situated where Victoria, B. C., now stands, was the best northerly site for the western headquarters, and in 1843 he built a fort there, the nucleus of the present city. The Treaty of 1846 finally broke the company's monopoly in United States territory below lat. 49° N. (See NORTHWEST BOUNDARY DISPUTE; OREGON, *History*.) In 1846 Douglas was appointed senior officer of the Western Department, and in 1851 he became Governor of Vancouver Island, which had been acquired by the company and was afterward created a crown colony. For seven years he combined the functions of civil ruler and chief factor of the company, whose long discipline of its officers and servants, as well as of the Indian tribes, had instilled habits of order and justice. In 1858 the rush of miners into the country con-

sequent to the discovery of gold severely tested his administrative skill; but in this Douglas, though competent, was assisted by Sir Matthew Baillie Begbie (1819-94), a judge whose fearless vigilance and impartial decisions were thoroughly effective in preserving order. In 1859, after the exciting episode of the military occupation of the island of San Juan by the American General Harney, the mingled firmness and forbearance of Douglas made possible the subsequent joint occupation of the island by American and British troops. (See SAN JUAN BOUNDARY DISPUTE.) In 1856 representative government was established in Vancouver Island, and in 1858 the crown colony of British Columbia was created. Douglas held the governorship of the two colonies concurrently until 1863. His vigorous promotion of road building was essential to the progress of British Columbia. He retired from public life in 1864. Although in full vigor of mind and body, he relinquished office chiefly because of his lack of training for, and intelligent sympathy with, the complicated tasks of representative government. His official experience had been that of a benevolent autocrat. In 1863 he was knighted. After his retirement he made a trip to Europe and returned to Victoria, where he died. Consult Begg, *History of British Columbia* (1894), and Coats and Gosnell, *Sir James Douglas* (1908), in the "Makers of Canada Series."

**DOUGLAS, JAMES** (1837- ). An American mining engineer and metallurgist. He was born in Quebec and was educated in Edinburgh and at Queen's University, Kingston, where he graduated in 1858. He studied theology and was ordained to the Presbyterian ministry, but after some years resigned. For a time he was professor of chemistry in Morrin College, Quebec, and in 1869 and subsequently he was president of the Literary and Historical Society of that city. In 1875 he went to Phoenixville, Pa., to take charge of copper works. He was remarkably successful in mining and railway enterprises and became president and business manager of a number of mining corporations, besides serving as president of several railways in Mexico. He was a delegate from the United States to the Mining Congress at Paris in 1900, and he was president of the American Institute of Mining Engineers in 1899-1900. He published: *Memoir of J. S. Hunt, F.R.S.* (1898); *Untechnical Addresses on Technical Subjects* (1905); *Old France in the New World* (1905); *The Influence of the Railroads of the United States and Canada on the Mineral Industry* (1909); *Journals and Reminiscences of James Douglas, M.D.* (1910).

**DOUGLAS, JOHN** (1721-1807). An English author and divine, the son of a shopkeeper at Pittenweem, Fifeshire, Scotland, educated at Dunbar and Oxford, and ordained deacon in 1744. As an army chaplain he was present at the battle of Fontenoy (1745). Two years later he was ordained priest. Preferment after preferment followed until in 1791 he became Bishop of Salisbury. He died May 18, 1807. Douglas only occasionally resided on his livings. He generally spent the winter in London and the summer at fashionable watering places, in the society of the Earl of Bath, who was his great patron. Among his writings, mostly controversial, are: *Vindication of Milton from the Charge of Plagiarism, Adduced by Lauder* (1750); *A Letter on the Criterion of Miracles*



(1752), a reply to Hume; and many political pamphlets. He also edited the journals of Captain Cook. His *Miscellaneous Works*, edited and . . . . . *Life* by Macdonald, were published . . . . . (1820).

**DOUGLAS, SIR JOHN SHOLTO.** See QUEENSBERRY, MARQUIS OF.

**DOUGLAS, SIR ROBERT KENNAWAY** (1838–1913). An English Sinologue, born at Larkbear House, Devon. He was attached to the English Legation at Peking, and subsequently taught Chinese in King's College, became governor of Dulwich College and keeper of Oriental books and manuscripts in the British Museum, and retired in 1907. He wrote articles on China and the East in the *Encyclopædia Britannica*, a catalogue of the Chinese books and manuscripts in the British Museum (1877), and *Two Lectures on the Language and Literature of China* (1875); *The Life of Jenghiz Khan* (1877); *Confucianism and Taoism* (1879); *China* (1882); *The Life of Li Hung-chang* (1895); *China* (1906); *Europe and the Far East* (1904; 1913).

**DOUGLAS, ROBERT LANGTON** (1864– ). A well-known English art critic, lecturer, and author. He was educated at New College, Oxford, was for years a University Extension lecturer, and for a time was in holy orders in the Church of England. From 1895 to 1900 he resided in Italy, and from 1900 to 1902 was professor of modern history at the University of Adelaide (Australia). He also lectured on art at the Royal Institution and the Society of Arts, was made dean of the faculty of arts in 1901, and contributed to many magazines and reviews. Known chiefly as an authority on Sienese art, his most important publications are: *Ira Angelico* (2d ed., 1902); *History of Siena* (1902); *Le Maioliche di Siena* (1904); a new edition of Crowe and Cavalcaselle's *History of Painting in Italy* (1903 et seq.); *Illustrated Catalogue of Pictures of Siena and Objects of Art* (Burlington Fine Arts Club, 1904). He was elected a fellow of the Accademia di Belle Arti, Milan.

**DOUGLAS, STEPHEN ARNOLD** (1813–1861). An eminent American political leader. He was born in Brandon, Vt., April 23, 1813. He passed his boyhood in his native State and in western New York, went to Illinois in 1833, taught school and studied law for a year, was admitted to the bar in 1834, and began practice in Jacksonville. Within a year he was elected State's attorney for the most important judicial circuit in Illinois, and his rise thenceforward was rapid and brilliant. In 1836 he was elected to the Lower House of the State Legislature and in the following year was made register of the Federal land office at Springfield. In 1838 he was an unsuccessful Democratic candidate for Congress, but in January, 1841, was appointed Secretary of State of Illinois, which position, however, he resigned within a month to take a seat on the bench of the Supreme Court of the State. After two years he resigned this position also, and thereafter served in Congress, first as a representative (from 1843 to 1847) and then as a senator, from 1847 until his death. In figure he was below the middle height, but his frame was vigorous and his manner impressive. "Little Giant," says Schouler, "he was presently called: for, being both able and adroit in policy and full of resources, he gave the image of power under

close compression." As chairman of the Committee on Territories, first in the House and then in the Senate, his position was peculiarly important. He favored the annexation of Texas and the Mexican War, opposed the Wilmot Proviso (q.v.), defended the Compromise measures of 1850, and upheld the extreme demands for the Oregon Territory. He became especially conspicuous, however, through his proposal and advocacy of the doctrine of "popular sovereignty," or "squatter sovereignty," which denied the power of the Federal government to legislate on slavery within the Territories and recognized the right of the people of each Territory to legislate upon the subject for themselves. This doctrine, first announced by Lewis Cass (q.v.), in December, 1847, was definitely formulated by Douglas in 1854, when he presented the Kansas-Nebraska Bill, which precipitated anew the struggle over the extension of slavery in the national Territories. The bill, in its first draft, also in precise terms announced the doctrine that the Missouri Compromise had been superseded by the Compromise of 1850, and, although nothing in the statutes warranted such an assertion, its political effect was great and immediate. The passage of the act brought upon Douglas much harsh criticism throughout the North, and indicated, on the other hand, the increasing strength of the upholders of slavery. (See KANSAS-NEBRASKA BILL.) Douglas now became, more than ever, a national force. Nevertheless, in 1856, as in 1852, he failed to secure the presidential nomination. In 1857 he broke with President Buchanan and the "administration" Democrats, thereby losing much of his prestige in the South. His campaign in 1858 for the election of the State I . . . . . which was to name his successor . . . . . led to the famous debates with Lincoln, in which the problems of slavery were thoroughly discussed and the foundation laid for the national reputation of his opponent. Douglas secured a reelection to the Senate, but his position had become so altered through his opposition to the recognition of the Lecompton Constitution in Kansas and by reason of his "Freeport Doctrine" (see FREEPORT, Ill.), that in 1860 he was unacceptable to Southern Democrats as a presidential candidate. However, the Northern Democrats would not support for the presidency a man holding the prevailing Southern views on slavery. This brought about a sectional division of the nominating convention and the subsequent nomination of Douglas for the presidency by his Northern followers assembled in Baltimore. In the ensuing election he received only 12 electoral votes, but his popular vote was next to that of Lincoln. His influence continued to be strong, and his hearty support of Lincoln's administration upon the outbreak of the Civil War was of powerful effect in the defense of the Union. Consult: *Life of Stephen A. Douglas*, by J. W. Sheahan (New York, 1860); vols. i and ii of Rhodes's *History of the United States from the Compromise of 1850* (7 vols., New York, 1892–1906); *Stephen Arnold Douglas* (Boston, 1902), by W. G. Brown, in the "Riverside Biographical Series"; E. C. Carr, *Stephen A. Douglas* (Chicago, 1909).

**DOUGLAS, THOMAS.** See SELKIRK, THOMAS DOUGLAS, fifth EARL OF.

**DOUGLAS, SIR WILLIAM FETTES** (1822–91). A Scottish figure and landscape painter, born



in Edinburgh. He was a pupil of Lauder, but in the main was self-taught. After exhibiting portraits in the Royal Scottish Academy he gained a reputation with his pictures representing occult and romantic subjects, such as "Bibliomania" (1852, National Gallery, London); "The Rosicrucian"; "The Alchemist" (1855, South Kensington Museum); "Visit to the False Astrologer" (1860). These compositions are simple and dignified, with a gleaming, luminous tone, reminiscent of the old masters. He was an ardent antiquarian and introduced the objects of his collection into his pictures. After 1870 he started to paint landscapes which include "Stonehaven" and the "Bay of Lunan," in the Edinburgh Gallery, and towards the close of his life he produced some delicate water colors. Douglas was curator of the National Gallery of Scotland, and president of the Royal Scottish Academy for many years. Consult *Photogravures from the Works of Sir W. F. Douglas, with a Critical Sketch by J. M. Grey* (1885).

**DOUGLAS, WILLIAM LEWIS** (1845- ). An American manufacturer and politician, born in Plymouth, Mass., and educated in the public schools. He began work at the age of seven in a shoe factory and in 1865 went to Colorado, returning to Brockton, Mass., in 1876 and establishing a shoe factory. From this beginning he had built up by 1914 a business having six factories with a combined capacity of more than 20,000 pairs of shoes daily, the source of supply of his 78 retail stores. He was a member of the Massachusetts Legislature from 1883 to 1887 and in 1891 was elected mayor of Brockton. In 1904 he was elected Governor of Massachusetts on the Democratic ticket.

**DOUGLAS CITY.** A town on Douglas Island, opposite Juneau, Alaska, mainly occupied by workmen of the adjacent Treadwell gold mines. The native village, or quarter, has a government school for the training of the Tlinkit children. Pop., 1910, 1722.

**DOUGLAS FIR.** See SPRUCE.

**DOUGLASS, DAVID BATES** (1790-1849). An American civil and military engineer, born at Pompton, N. J. He graduated at Yale in 1813, entered the army, and rendered effective service in the defense of Fort Erie against the British. In 1819-20 he was assistant professor of natural and experimental philosophy at West Point. Subsequently he held the professorship of mathematics and from 1823 that of civil and military engineering, which he resigned in 1831 to become chief engineer of the Morris Canal Company. His most important engineering work for New York City was the making of surveys and plans for the Croton Aqueduct and for Greenwood Cemetery. He was president of Kenyon College from 1841 to 1844 and was made professor of mathematics at Hobart College in 1848.

**DOUGLASS, FREDERICK** (1817-95). An American antislavery orator and journalist, born at Tuckahoe, near Easton, Md. His father was a white man, his mother a negro slave, and he was reared as a slave on the plantation of Col. Edward Lloyd until he was 10 years old, when he was transferred to a relative of his owner in Baltimore. There he worked in a shipyard and taught himself to read and write. In 1838 he escaped from slavery under the disguise of a sailor and changed his name from Frederick Augustus Washington Bailey to Fred-

erick Douglass. He proceeded first to New York City and then to New Bedford, Mass., where he married a negro woman, and where for several years he was employed as a day laborer. In 1841 he attended an antislavery convention at Nantucket and spoke with such power and eloquence that the Massachusetts Antislavery Society sent him out as a lecturer under its auspices. He met with so much success that an invitation to lecture in Great Britain was extended to him and was accepted. In 1845 he published his autobiography and went to England, where he remained two years, and where a contribution of £150 was raised to buy his freedom in regular form. On his return to America in 1847 he settled at Rochester, N. Y., and began to publish a weekly Abolition newspaper, which was continued until 1860, being called the *North Star* until 1850, when it was renamed *Frederick Douglass's Paper*. In 1855 he rewrote his autobiography, which was republished in 1882 as the *Life and Times of Frederick Douglass*. During the Civil War he was among the first to suggest the employment of negro troops by the United States government. In 1871 he was secretary to the Santo Domingo Commission; in 1872 a presidential elector for the State of New York; in 1877-81 United States Marshal for the District of Columbia; in 1881-86 recorder of deeds in the District; and in 1889-91 Minister to Haiti. Consult lives by Holland (New York, 1891) and by Chesnut (Boston, 1899). Consult Booker T. Washington, *Frederick Douglass* (Philadelphia, 1907).

**DOUKHOBORS.** See DUKHOBORTSKY.

**DOULS, CAMILLE** (1864-89). A French explorer, born at Rodez. He entered upon his tours of exploration in 1887, when he visited the region south of Morocco in the disguise of a Mussulman merchant. He was captured and imprisoned by one of the native tribes, but subsequently liberated, and succeeded in reaching Morocco. In 1888 he began another tour, intending to proceed through the Sahara as far as Timbuktu; but after penetrating for a considerable distance into the country he was assassinated by his two Tuareg guides. The results of his first voyage were published in the *Bulletin de la Société de Géographie* (1888), *Revue de Géographie* (1888), and in *Le Tour du Monde* (1888).

**DOULTON, SIR HENRY** (1820-97). An English potter, born in Vauxhall. He learned his profession in his father's factory at Lambeth, which he soon developed into the largest pottery works in the world, and it was chiefly he who effected the revival of "art pottery." The most noteworthy of his ware was the "sgraffito," which traced its origin to the agate or self-glazed stoneware of the latter part of the seventeenth century. He created a sensation at the South Kensington Exhibition in 1871, which was followed by further exhibits in Vienna and Paris. Branch factories were opened throughout England and in Paris, and the ware was introduced into the United States in the seventies by John Bennet, a former director of the Lambeth works. A school of art was conducted in conjunction with the undertaking, and distinctive features were introduced. Since the business was turned into a joint-stock company in 1899, the artistic value of its ware has declined. Consult Chaffers, *Pottery and Porcelain* (London, 1900), and Barber, *The Pottery and*

*Porcelain of the United States* (3d ed., New York, 1909).

**DOUMER**, dōm'mē', PAUL (1857- ). A French statesman, born at Aurillac (Cantal). He became in 1885 chief assistant to Floquet, President of the Chamber of Deputies, and in 1888 and 1890 was elected as a Radical deputy. He was Minister of Finance in the Bourgeois cabinet (1895-96) and from 1896 to 1902 was Governor-General of French Indo-China, where he carried through important public works and the political and financial unification of the French possessions. Reëntering the Lower House in 1902, he became head of the Budget Commission, and, in 1905, President of the Chamber. In 1906 he was the candidate of the moderate and reactionary parties for President of the Republic to succeed Emile Loubet, but received only 371 votes to 449 for Armand Fallières (January 17). In 1909 he was again head of the Budget Commission. In 1910 he failed of reelection to the Chamber. He published *L'Indo-Chine française* (1904) and *Livre de mes fils* (1905).

**DOUMERGUE**, dōm'mērg', EMILE (1844- ). A French Protestant church historian, born in Nîmes, and educated at Geneva, Montauban, Erlangen, and Berlin. In 1871-80 he edited the periodical called *Le Christianisme au XIXe Siècle*, and he became professor of Church history and dean of the Protestant theological faculty at Montauban. His great work is his biography of Calvin, entitled *Jean Calvin: les hommes et les choses de son temps* (5 vols.: vol. i, 1899; vol. iv, 1910), the result of a lifelong study of the subject, upon which he wrote many minor volumes, notably *Iconographie calvinienne* (1909).

**DOUMERGUE**, GASTON (1863- ). A French statesman, born at Algues-Vives (Gard). He studied law, served as an advocate at Nîmes in 1885-90, and was colonial magistrate in Cochinchina in 1888 and in Algiers in 1890-93. As a member of the Radical-Socialist party, he was elected a deputy from Nîmes and reëlected in 1898, 1902, and 1906, and he was Secretary in 1895-96 and Vice President in 1905-06 of the Chamber. He served as Minister of the Colonies (1902-05) in the Combes cabinet, as Minister of Commerce (1906-08) in the Sarrien and Clémenceau cabinets, and as Minister of Public Instruction (1908-10) in the Clémenceau and the first Briand cabinets. Later Doumergue became a member of the French Senate, and in December, 1913, he was called on to form a new ministry, in which he held the portfolio of Foreign Affairs as well as the premiership. In June, 1914, he resigned, with his cabinet.

**DOUMIC**, dōm'mék', RENÉ (1860- ). A French literary and dramatic critic, born at Paris and educated at the Lycée Condorcet and the Ecole Normale Supérieure. Besides serving as professor at Stanislas College, he lectured in Canada and at Harvard University in 1898. He became especially known for his criticisms published in the leading French journals. He became Chevalier of the Legion of Honor and in 1909 was elected a member of the Academy. His writings include: *De Scribe à Ibsen* (1893); *Ecrivains d'aujourd'hui* (1894); *Etudes sur la littérature française* (5 vols., 1896-1905); *Les jeunes* (1896); *Essais sur le théâtre contemporain* (1897); *Hommes et idées du XIXe siècle* (1903); *Les*

*lettres d'Elvire à Lamartine* (1905); *Le théâtre nouveau* (1908); *George Sand* (1909); *Lamartine* (1912); *Histoire de la littérature française* (30th ed., 1913).

**DOUR**, dōr. A town in the Province of Hainaut, 9 miles S. of Mons (Map: Belgium, B 4). Coal and iron mines and stone quarries are worked in the vicinity, and some coke is produced. There is also a thread mill and a rope factory. Pop., 1900, 11,425; 1910, 12,670.

**DOURINE**, dōō'rēn. Dourine, or maladie du coît, is a specific infectious disease of the horse and ass, transmitted from animal to animal by the act of copulation and caused by a protozoan parasite, the *Trypanosoma equiperdum*. The disease is characterized by an irregular incubation period, the confinement of the first symptoms to the genital tract, the chronic course which it runs, and by finally producing complete paralysis of the posterior extremities, with a fatal termination in from six months to two years. It occurs in Asia, Africa, and continental Europe, and has been introduced into the United States several times with imported stallions. At the present time (1914) its eradication from eastern Montana and the Dakotas, in which it is known still to occur, is under way by the United States Department of Agriculture.

In mild cases an apparent recovery may follow, and through such animals the disease is disseminated. It is now readily detected by the blood test known as complement fixation. Treatment of the disease has proved unsatisfactory. It should be stamped out by the slaughter or castration of every horse or mare that has had sexual congress with a diseased animal or which gives a positive blood test.

Consult: Hutyra and Marek, *Pathology and Therapeutics of the Diseases of Domestic Animals*, vol. i (London, 1912); E. W. Hoare, *A System of Veterinary Medicine*, vol. i (2d ed., New York, 1906); J. R. Mohler, "Dourine of Horses: Its Cause and Suppression," in *United States Department of Agriculture, Bureau of Animal Industry, Bulletin 142* (Washington, D. C.).

**DOURO**, dō'e-rō. See DUERO.

**DOUROUCOULI**, dōō'rōō-kōō'lē (South American Indian). A small monkey of Brazil of the genus *Nyctipithecus* or *Aotus*, sleeping by day but active and fierce at night in pursuit of birds and insects. The body is about 9 inches long, the tail 14; fur soft and grayish white, with a brown stripe down the back. The head is round, and the eyes are extremely large and prominent. Douroucoulis look more like cats than monkeys and sit up like dogs. Several species are known, all confined to South America, where they represent the lemurs of the Old World. Consult Bates, *The Naturalist on the River Amazon* (London, 1863), and Elliot, *Review of the Primates*, vol. ii (New York, 1913).

**DOURRA**, dōō'rā. See SORGHUM, paragraph Nonsaccharine.

**DOUSA**, JANUS (JAN VAN DER DOES) (1545-1604). A Dutch statesman, scholar, and historian, born in Noordwijk, and educated at Delft, Louvain, Douai, and Paris. In 1572 he was sent by the Estates of Holland on an embassy to England; and in 1574 was Governor of Leyden when it was besieged by the Spaniards. When the University of Leyden was founded, he was appointed first curator, and the

success of the university was largely due to his wisdom. In 1584 and 1585 he was again in England trying to interest Queen Elizabeth in the cause of the States. In 1591 he was appointed a member of the Sovereign Council. His principal work was the *Annals of Holland* (*Annales Rerum*), a Latin hexameter history, covering the period 898–1218 A.D. He wrote a commentary on Horace and criticized Catullus, Tibullus, Petronius, etc.

**DOUVILLE**, *doo'vél'*, JEAN BAPTISTE (1794–c.1835). A French traveler, born at Hambye, Manche, France. He traveled extensively in Asia and South America, and in 1832 published in three volumes *Voyage au Congo et dans l'intérieur de l'Afrique équinoxiale*, describing his discoveries in Central Africa. For this he was honored with the gold medal of the Société de Géographie of Paris and with honorary membership in the Royal Geographical Society of London. Later, however, his work was shown to be a fabrication based on early Portuguese discoveries.

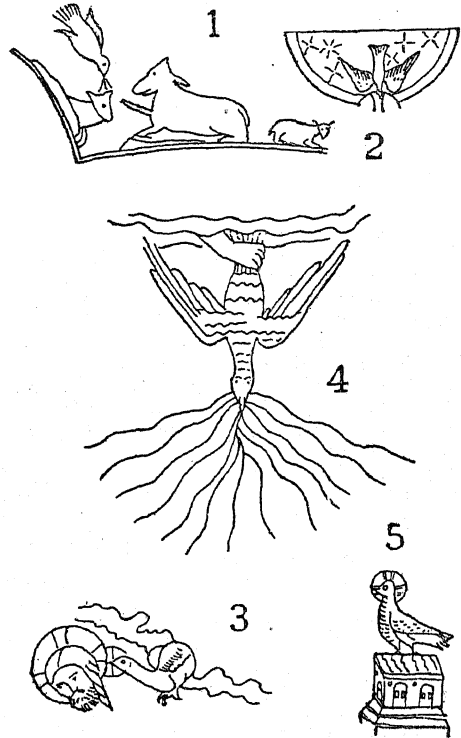
**DOUW**, *dou*, GERARD. See DOU, GERARD.

**DOUZETTE**, *doo-tsét'te*, LOUIS (1834– ). A German landscape painter. He was born at Triebsees, Pomerania, and studied with Eschke at Berlin. His specialty was moonlight painting, in which genre he excelled. Among his best works are "Moonlight Night in Winter" (1865); "Swedish Coast by Moonlight" (1866); "Moonlight on the Gulf of Venice" (1876, Melbourne); "Moonlight on the Fjord" (1883, Dresden Gallery); "Harbor of Lübeck by Moonlight" (1891); "Old Prerow on the Dars" (Berlin Gallery), one of many paintings of the German beech and oak forests. He was strongly influenced by the Barbizon painters and also by the Dutch, especially Ruysdael. Douzette received the gold medal at the Berlin Art Exhibition of 1886.

**DOVE** (*Icel. dúfa*, *Ger. Taube*, *Dutch duif*, *Goth. dūfō*, perhaps connected with *Ir. dub*, black, or possibly with *AS. dyfan*, to dip, from *dāfan*, to dive). A pigeon. No scientific distinction separates pigeons from doves, but the latter word is attached usually to the smaller forms of this group, such as the turtle, ring, ground, and scaled doves. (See *PLATE OF PIGEONS*.) The turtle doves are small, graceful, modestly dressed representatives of their kind, erroneously considered as the type of gentleness. The common European species (*Turtur*, or *Streptopelia, communis*) is migratory, and seems to be increasing. Another of the many Old World species, abundant in Asia Minor and eastward, is regarded as the "turtle" of Scripture. In the United States the bird frequently called turtle or mourning dove is *Zenaidura macroura carolinensis*, whose plaintive, throbbing refrain in early summer is familiar throughout the whole land and makes its name, "mourning dove," seem very appropriate. It is migratory, but with the spread of civilization and consequent increasing certainty of food about barns, etc., it is coming to remain more and more in the northerly districts throughout the winter. The scaled doves (*Scardafella*) are small and beautiful species of semitropical America; and another group belonging to the warmer parts of America and of terrestrial habits are called ground doves. Doves' nests are very slight structures, and the eggs are white. An example (that of the American Zenaida dove) is shown on the Colored Plate of

EGGS OF WATER AND GAME BIRDS with the article Egg.

**Symbolism of the Dove.** The dove has taken a large place in legend, folklore, and poetic and religious symbolism. Proper names derived from the dove have always been used in the Orient as descriptive of loveliness and were especially applied to beautiful women. The name "Semiramis" is said to mean "mountain dove," and the bird became the ensign of her army. Mr. Charles De Kay relates in his *Bird Gods* (New York, 1898) how extensively the dove was woven into the pagan worship of ancient Europe, and its place in early Christian art and religious symbolism is prominent. The people of northern Europe used to say that the



1. Dove as Holy Spirit; shedding blessings on the Saviour (Agnus Dei) at his baptism. Earliest example of the dove in Christian art. (From a bas-relief on the tomb of Junius Bassus, 359 A.D.)
2. Descent of the Holy Spirit as a dove upon Jesus; Heaven is represented as a circle studded with stars. (From a manuscript of the ninth century in the British Museum.)
3. The Holy Spirit as a dove speaking into the ear of Jesus at his baptism. (From a French manuscript, 1100 A.D., in the British Museum.)
4. The hand of God extending grace or a blessing as a dove from heaven. (From a Saxon manuscript in the British Museum.)
5. Dove standing on the altar. (From an Italian altar stone of the twelfth century.)

ringdove or cushat perched near the cross when Jesus was expiring and wailed its sorrow to alleviate his agony. To the Jews, from an immemorial time, it had been a type of innocence, and elsewhere it had been associated since the Olympian age with the higher idea of Venus as a symbol of natural human affection—the love that goes with, or proceeds from, purity and simplicity of heart. It had a part in marriage scenes and was naturally introduced by early painters into pictures of the Madonna and

Child and of female saints. These qualities, combined with their mournful notes, made doves equally appropriate to moods of sorrow, and they were a part of the furniture of most pagan



6. Dove typifying grace of the Holy Spirit descending upon a Christian in baptism. (From a painting, "Baptism of Verrocchio," in Florence.)

funerals. This passed on into Christian usage, and their likenesses, generally with an olive branch, were carved on thousands of tombs in the catacombs beneath Rome and elsewhere, emblematic of eternal peace. Various meanings seem to have been attached to these mortuary carvings, but the prevalent idea was that of



7. The Seven Gifts of the Spirit. This is a clear rendering of a theme which appears under many and sometimes confusing disguises. In this case it is notable that no nimbus or aureole is present, the circle of seven doves about the head of Jesus themselves forming a sort of aureole.

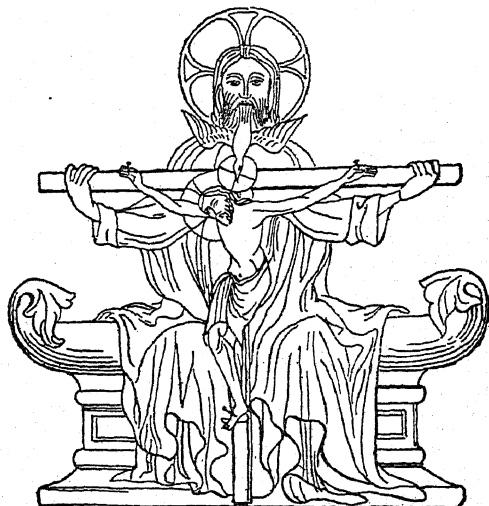
8. The dove "moving on the face of the waters" at the creation. (From a Saxon manuscript of the eleventh century, in the British Museum, where the Creator is represented above this figure holding compasses and scales.)

9. The Holy Spirit, in human form, holding a dove as a symbol. (From a sculpture of the sixteenth century, in the church of Verrières.)

portraying the departure of the soul from the body; and, later, artists often represented a white dove issuing from the lips of dying martyrs, as occurs in old pictures of Santa

Scholastica, the sister of St. Benedict, and of Santa Eulalia, the Spanish girl martyr who expired under tortures inflicted by the Emperor Diocletian. Hereby the human soul is represented as purified by suffering.

A very natural specialization of this idea was to make an approaching dove symbolize the divine soul or Holy Spirit, first in the general sense of heavenly messenger (i.e., inspirer), and next as the third person of the Trinity. In the former sense it is almost invariably placed in old pictures near certain saints who are supposed to have been particularly inspired, as St. Thomas Aquinas, St. Hilary, and others. Few, if any, early paintings of Pope (St.) Gregory the Great exist in which a dove is not resting upon his shoulder or hovering at his ear, whispering messages from on high. In this sense, but especially in that of signifying the Holy Ghost, the dove appears in most of the early representations of scenes in Christ's life—most frequently, perhaps, in pictures of his



10. An Italian representation of the Trinity, the Father and the Son in human form, and the Holy Spirit symbolized by a dove born from the breath of the Father and descending upon the Son. (Fourteenth century.)

baptism, literally rendering St. John's words (i. 32): "I saw the Spirit descending from heaven like a dove." The earliest instance of it in Christian art known to Mrs. Jameson is a bas-relief from a tomb dated 359 A.D. "The next instance," she cites, "is from a mosaic in the church of Santa Maria Maggiore, Rome, fifth century, and is the earliest representation of the Annunciation."

In the early pictures the dove's head is surrounded with a golden nimbus, which is frequently cruciform. Seven rays proceed from it, terminating in seven stars, signifying the "seven gifts of the Holy Spirit." In her *Symbols and Emblems of Christian Art* Louisa Twining gives varied examples of its treatment. Sometimes seven doves are attributes of the Virgin, occasionally within a *vesica piscis*. An English manuscript poem of the fourteenth century is illustrated by a series of scrolls inscribed: "Ye gyfte of Wisdome; Ye gyfte of pite; Ye gyfte of Strengthe; Ye gyfte of counsaill; Ye gyfte of Understandinge; Ye gyfte of connyng; Ye gyfte of diiede [a misprint for *dreede*, meaning dread,

fear].” Around the page are the lines below, in Old English text:

“In this desert wild and waste,  
Seven fowls are flying with flight,  
That are seven gifts of the Holy Ghost,  
That nowhere but in clean hearts will light  
And dwell there if they find them chaste,  
And give them ghostly strength and might  
So big and bold that they then haste  
To pray to God both day and night.”

A dove with six wings is a type of the Church of Christ. Sometimes the pyx is in the form of the dove, suspended above the altar, the covers of fonts often bear the same image, and it is common as a symbolic decoration of baptisteries. Twelve doves represented the Twelve Apostles, and the bird is the emblem of any believer whatever.

The dove belongs to various legends more or less remote from the present line of thought. Thus, the emblem of St. Remigius is a dove with an oil cruse in its beak, “recalling that at the anointing of King Clovis a cruse of oil was brought from heaven by a dove at the prayer of this saint.” In other cases it represents a visual benediction descending upon a cross or upon the sacred monogram. Thus, the significance of the bird came to be so broad as to mean simply *Christian*.

**DOVE.** The dove is by the common law a wild animal (*feræ naturæ*), and, as such, not the subject of larceny, unless at the time of the taking in the custody of the person asserting ownership. An escaped pigeon is, like other wild things, common property; but if it be domesticated, or if found in a dovecot, it partakes of the status of domestic animals and is protected like other personal property. The right of erecting or keeping dovecots was in England, as well as in Scotland, in Normandy, and elsewhere, an exclusive privilege of the feudal lords and was rigorously protected by law, but such exceptional privileges have long been abolished. See *FERÆ NATURÆ*.

**DOVE, dō've, ALFRED** (1844– ). A German historian. He was born in Berlin, a son of Heinrich Wilhelm Dove (q.v.). After studying medicine and the physical sciences at Heidelberg and Berlin (1861–66), he became a journalist and was successively the editor of the *Grenzboten* (1870) and of the publication *Im Neuen Reich*. During the period 1874–91 he was professor of history at Breslau (1874–84) and Bonn (1884–91). Returning to his journalistic activity in the latter year, he became for a time editor of the *Allgemeine Zeitung* in Munich. He published the posthumous manuscripts of Von Ranke, completing both the *Weltgeschichte* and the editing of the *Sämtliche Werke* of that celebrated author in 1890, after an arduous labor of four years. Among his own publications may be mentioned *Deutsche Geschichte im Zeitalter Friedrichs des Grossen und Joseph II.* In 1891 he edited the last volumes of Bismarck's parliamentary speeches.

**DOVE, HEINRICH WILHELM** (1803–79). A German physicist and meteorologist, born at Liegnitz, in Silesia. He studied at Breslau and Berlin. He was successively privatdocent and assistant professor of natural philosophy in Königsberg. He was transferred to the University of Berlin in 1829 and in 1837 was elected to a seat in the Academy of Sciences. His writings, which are very numerous, are to be found for the most part in the memoirs of that

academy and in Poggendorff's *Annalen*. His works include researches dealing with meteorology, climatology, induced electricity, and circularly polarized light. Among his works may be mentioned: *Ueber Mass und Messen* (1835), a treatise on the art of measuring, and the origin and comparison of the metrical standards of different nations; *Meteorologische Untersuchungen* (1837); *Ueber die nicht periodischen Aenderungen der Temperaturvertheilung auf der Oberfläche der Erde* (1840–47); *Untersuchungen im Gebeit der Inductionselectricität* (1843). In his capacity of director of the Royal Observatory he published annually an account of his labors and observations. The treatise on the *Distribution of Heat on the Surface of the Globe*, which was published in 1853 by the British Association, is also a work of importance. In this work he enters fully into the causes of periodic variations of temperature at different parts of the globe and lays down in admirable charts the monthly and annual isothermal and isabnormal lines, thus tracing the variations in form and position of the different isothermals throughout the year. *Das Gesetz der Stürme* (4th ed., 1874) has also been translated ('The Law of Storms'). Other works are: *Ueber Electricität* (1848); *Optische Studien* (1859); *Eiszeit, Föhn und Sirocco* (1867); *Klimatologie von Norddeutschland* (1871).

**DOVE, RICHARD WILHELM** (1833–1907). A German jurist, son of Heinrich Wilhelm Dove. He was born in Berlin, studied both ecclesiastical and civil law at Berlin and Heidelberg, and was appointed professor successively in the universities of Tübingen, Kiel, and Göttingen. In 1873 he was nominated a member of the Prussian Court of Ecclesiastical Affairs. Most of his writings were published in the *Zeitschrift für Kirchenrecht*, a leading European organ of ecclesiastical law, which he established and began to edit in 1860.

**DOVE FLOWER, or PLANT.** See *HOLY SPIRIT PLANT*.

**DOVEKIE** (probably from *dove* + diminutive *-kie*). The little auk (*Alle alle*), sea dove, or rotge, an Arctic sea bird (see *AUK*), which regularly appears in winter on the coasts of Norway, northern Scotland, and America as far south as Maine, where it is called pine knot. Occasionally it is driven farther south or inland. It is about 8 inches long, black and white in color, has a bill like a partridge, and flies and dives with extreme swiftness and dexterity. It feeds upon small fish, crustacea, worms, etc., and frequently great numbers are found dead on our coasts, starved or crushed by the icy gales. In summer it becomes sooty brown and resorts in countless hordes to the most northerly islands and headlands to breed—especially to Spitzbergen, where each pair hide their single white egg deep in the recesses of the loose rocks of the coast mountains or, failing that cover, on some ledge. The same name is given by sailors to the black guillemot (*Cephus grylle*).

**DOVE PLANT.** See *HOLY SPIRIT PLANT*.

**DOVER.** A parliamentary and municipal borough of Kent, England, on the Strait of Dover, at the mouth of the Dour, 76 miles by rail east-southeast of London (Map: England, H 5). It is the headquarters of the southeastern district of the British army and is not only a charmingly situated watering place, but, being the nearest point of the English coast to France, 21 miles distant, is a seaport of importance.

Among the noteworthy buildings in Dover, aside from its fortifications, are the two ancient churches of St. Mary and Old St. James; the Maison Dieu, founded in the thirteenth century as a pilgrims' hospital, but now used for municipal purposes as a part of the new town hall; and the remains of St. Martin's Priory, incorporated as a part of Dover College. The fortifications are very extensive. On the chalk cliffs to the east of the town rises Dover Castle, founded by the Romans and fortified and enlarged by the Saxons and Normans. It contains the remains of a Roman pharos and an old fortress church, a unique specimen of Roman-British architecture. To the north of the castle is Fort Burgoyne, a drop redoubt, the north centre bastion and citadel. On these heights are large barracks and the ruins of another pharos and of a circular church of the Knights Templars.

Very extensive harbor improvements, begun in 1893, were carried out in subsequent years. On the west the Admiralty Pier (about 2000 feet, completed 1871) was extended in a southeasterly direction for 2000 feet; on the south an isolated breakwater was erected, extending to within a few hundred feet of another breakwater (3320 feet) built out from the mainland to form the eastern limit of the harbor. Within the harbor thus practically inclosed is still another pier (Prince of Wales, completed 1902), running nearly parallel with the old Admiralty Pier and forming with the latter a sheltered area of 75 acres. The entire harbor has an area of 610 acres, of which over half has a minimum depth of 30 feet at low tide. For harbor defense three powerful forts were begun in 1909.

The corporation owns its water supply and owns and operates electric street railways. It maintains public baths, markets, and a technical school. Dover returns one member to Parliament. The United States is represented by a consular agent. The town has a miscellaneous maritime trade and an enormous passenger traffic to and from the Continent. The total tonnage entered and cleared in 1912, excluding coastwise vessels, was 4,497,861; combined imports and exports amounted to £15,759,169. Pop., 1901, 41,794; 1911, 43,645. In Roman days, Dover was known as Dubris; the Normans called it Dovore; the French, Douvres. Fortified and walled by William the Conqueror, during whose reign it was nearly burned down, noted as the place of King John's submission to the Pope, besieged by the French, held during the Civil War by the Parliamentarians, threatened by the first Napoleon, and long celebrated as the headquarters of the lord wardens of the Cinque Ports, Dover holds a place in the history of England. Consult *Steuart, History of Dover*, with a bibliography (London, 1899).

**DOVER.** The capital of the State of Delaware, and the county seat of Kent County, 48 miles by rail south of Wilmington: situated on St. Jones River, and on the Philadelphia, Baltimore, and Washington Railroad (Map: Delaware, J 2). It is regularly built on elevated ground. The Wilmington Conference Academy (Methodist Episcopal) and the State college for colored students, an agricultural and manual training school, are located here. The public buildings include the State House, which contains a State library of 80,000 volumes, the county courthouse, new State armory, and the post office. There are monuments to persons distinguished in Revolutionary history. The city,

situated in a noted fruit-growing region, has several fruit-canning and canning works. There are also planing and saw mills, foundry and machine shops, sash and door, paint, and basket and crate factories, flour mills, and an electrical-specialty factory. Dover was laid out in 1717, became the capital of Delaware in 1777, and was incorporated as a town in 1829. The government is vested in a mayor and eight councilmen, and the water works and electric plant are owned by the city. Pop., 1841, 3000; 1900, 3329; 1910, 3720.

**DOVER.** A city and the county seat of Strafford Co., N. H., 11 miles by rail northwest of Portsmouth, at the head of minor navigation on the Cocheco River, and on the Boston and Maine Railroad (Map: New Hampshire, J 7). The river here has a fall of over 30 feet, furnishing excellent water power. Dover is an important shipping port. The chief industries include the manufacture of cotton and woolen goods, machinery, castings, belting, bricks, printing presses, cutlery, lumber in various products, boots and shoes, etc.—industries which in 1912 employed about 4200 persons, represented a capital investment of about \$6,000,000, and produced an output valued at nearly \$7,000,000. Dover has a public library, a fine city hall and opera house, two hospitals, two children's homes, and a home for the aged. The city is governed by a mayor, elected annually, and a bicameral council, which controls the appointments to the subordinate municipal offices. The municipal water commission operates an efficient system of water works. First settled in 1623, and therefore the oldest city in the State, Dover was organized as a town in 1633, received its present name in 1639, and was chartered as a city in 1855. It was a frontier town throughout the seventeenth century and frequently suffered from Indian attacks, the most disastrous of which occurred on June 28, 1689, when 23 of the inhabitants were killed, 29 carried into captivity, and a number of houses destroyed. Pop., 1900, 13,207; 1910, 13,247; 1914 (U. S. est.), 13,264.

**DOVER.** A town in Morris Co., N. J., 39 miles by rail west by north of New York City, on the Rockaway River, the Morris Canal, and the Lackawanna and the Central of New Jersey railroads (Map: New Jersey, C 2). It has extensive ironworks, machine shops, stove, furnace, and range works, boiler and bridge works, rolling mills, drill works, knitting and silk mills, a large hosiery factory, and an overall factory. A government powder depot is located at Piccatinny, 5 miles from Dover. The town government, under a charter amended in 1875, is vested in a mayor, biennially elected, a recorder, aldermen, and councilmen, who constitute a unicameral municipal council. Dover was incorporated as a village in 1826 and in 1869 as a town. It has municipal water works. Pop., 1900, 5938; 1910, 7468.

**DOVER.** A town and the county seat of Stewart Co., Tenn., 67 miles (direct) west-northwest of Nashville, on the Cumberland River (Map: Tennessee, C 2). It is 1 mile from Fort Donelson and contains a national cemetery of 672 graves. Pop., 1914, about 600.

**DOVER, STRAIT OF.** A strait separating England from France and connecting the English Channel with the North Sea (Map: England, H 6). On the English coast its limits are defined by the promontories of Dungeness and South Foreland, and on the French coast it ex-



tends from Cape Gris-Nez to Calais. It is 20 to 27 miles wide and 1 to 20 fathoms deep. The Ridge Shoals near the middle of the strait are over 8 miles long and have a depth of 10 to 24 feet. Both the English and French shores are formed by chalk cliffs of corresponding strata, showing a former connection at this point. The strait has been carefully surveyed by engineers with a view to bridging or tunneling it. There is great opposition in England, on military grounds, against the construction of a tunnel. It is, perhaps, the most frequented maritime route in the world.

**DOVER'S POWDER** (named from Thomas Dover, an English physician of the eighteenth century, who first prepared it). An old preparation of powder of ipecacuanha 1 dram, opium in powder 1 dram, and sulphate of potash 1 ounce, the whole being thoroughly mixed. Sugar of milk is now substituted for the sulphate of potash, and occasionally saltpetre is added. The powder is used in domestic practice to induce abortion to abort a "cold," as well as at the beginning of any attack of fever; but it should be used cautiously, on account of the opium it contains.

**DOVE TICK.** A blind tick (*Argas reflexus*), well known in Europe as a parasite of doves and some other birds. A closely related species is the Asiatic *Argas persicus*, which dwells in houses "and by its punctures produces convulsions in man, and it is said that even death has resulted from its sting." A third species, the pique (*Argas nigra*), is also distressing. See TICK.

**D'OVIDIO**, dō-vēd'yō, FRANCESCO (1849- ). An Italian philologist and literary critic, after 1876 professor of romance philology at the University of Naples. His name is associated in Italy with that of Ascoli and D'Annunzio in the development of philology, science and in the critical study of literature from the historical standpoint. His scholarship, though not so intensive, has a very wide range.

**DOW, GERARD.** See DOU, GERARD.

**DOW, LORENZO** (1777-1834). An American preacher, noted for his eccentricities and zeal. He was born at Coventry, Conn., Oct. 6, 1777. His education was limited. In youth he joined the Methodists (1799), but left the official ministry under a conviction that he was called to be a missionary to the Roman Catholics of Ireland. His preaching in that country attracted crowds of people and brought him some persecution. He also visited England, introducing there the Methodist system of camp meetings. He returned to the United States, and repeated his visits to Ireland and England in 1805. He preached in many parts of the United States. His natural eloquence and his eccentricities of dress and speech attracted large audiences everywhere. He preached against Catholicism and especially against the Jesuits, whom he regarded as enemies of civil and religious liberty. His *Polemical Works* appeared in 1814. Among his other works are *The Life and Travels of Lorenzo Dow*, by Himself, in which are contained some singular providences of God (1804; 2d ed., 1806); *A Collection of Spiritual Songs Used at Campmeetings in the Great Revival in the United States of America* (1806); *The Stranger in Charleston; or, The Trial and Confession of Lorenzo Dow* (1822); *A Short Account of a Long Travel* (1823); and *The History of Cosmopolite* (1831). Consult his *Life and Writings* (New York, 1854). His wife,

Peggy Dow (1780-1820), was almost as eccentric as her husband. She published her journal, entitled *Vicissitudes in the Wilderness* (5th ed., 1833).

**DOW, NEAL** (1804-97). An American temperance reformer. He was born in Portland, Me., of Quaker parentage, and was educated at the Friends' Academy in New Bedford, Mass. He was twice mayor of Portland and in 1858-59 was a member of the State Legislature. In 1861 he was appointed colonel of the Thirteenth Maine Volunteers, which he commanded in General Butler's expedition to New Orleans. Promoted to the rank of brigadier general in 1862, he commanded the fortifications at the mouth of the Mississippi and later the Department of Florida. He was wounded and taken prisoner by the Confederates at Port Hudson in May, 1863, and was confined for eight months thereafter in Libby Prison. It was as a temperance reformer and orator, however, that he was best known. He was the author of the famous prohibition law enacted by the Maine Legislature in 1851, and traveled widely in the United States, Canada, and Great Britain, speaking on temperance questions and helping in the organization of societies for the furtherance of the reform. In 1880 he was the Prohibition candidate for President of the United States. Consult his *Reminiscences* (Portland, 1898).

**DOWAGER** (OF. *douagiere*, from *douage*, dower, from *douer*, *doer*, Fr. *douer*, It., Lat. *dotare* to endow, from Lat. *dos*, dower). A widow with a dower (q.v.). A title commonly applied only to the widows of persons of high rank. The queen dowager in Great Britain, as the widow of the king, enjoys most of the privileges which belonged to her as queen consort; but it is not high treason to conspire her death, because the succession to the crown is not thereby endangered.

**DOWAGIAC**, dō-wā'jāk. A city in Cass Co., Mich., 35 miles southwest of Kalamazoo, on the Michigan Central Railroad. It is in an excellent farming region, and has flour and lumber mills, a gas factory, and a canning establishment. The noteworthy features of the city are the Beckwith estate and the public library. Among other industries are manufactures of grain drills, stoves, gloves, bait, and furnaces. Pop., 1900, 4151; 1910, 5088.

**DOWDEN**, dou'den, EDWARD (1843-1913). A British scholar, critic, and educator, born in Cork, Ireland, and educated at Trinity College, Dublin, where his career as a student was brilliant, and where he became professor when in his twenty-fifth year. The chair of English literature in the University of Dublin he held up to the time of his death. *Shakespeare, His Mind and Art* (1875) at once established his reputation as a Shakespearean scholar. This work aimed to connect a study of the plays with a quest for the personality of the author of them and for the development of his intellect and character in their various stages of growth. It was followed by *Poems* (1876). In 1877 appeared the *Shakespeare Primer*, the best handbook of its type, owing to condensed information and critical concision. Next came *Studies in Literature* (1878), a volume of substantial and suggestive essays. His *Life of Shelley* (1886) is a notable work. A number of volumes of essays in literary criticism and several critical biographies followed, and in addition there was done much editorial work which bore, like everything that



came from Professor Dowden's pen, the stamp of a ripe scholarship and rare culture. His more important works, in addition to those already named, are: *Transcripts and Studies* (1888); *Introduction to Shakespeare* (1893); *New Studies in Literature* (1895); *A History of French Literature* (1877); *Robert Browning* (1904); *Michel de Montaigne* (1905); *Essays: Modern and Elizabethan* (1910). His collected *Poetical Works* (2 vols.) and *Letters* appeared in 1914. His editorial work includes: *Shakespeare's Sonnets*, *Southey's Correspondence with Caroline Bowles*, and the *Correspondence of Henry Taylor*; the poetical works of Shelley, Wordsworth, and Southey; and several of the plays of Shakespeare. In 1889 Professor Dowden was invited to lecture at Oxford; in 1893-96 he lectured at Trinity College, Cambridge; and in the last-named year at Princeton University, where his subject was *The French Revolution and English Literature*, and where he was honored with the degree of LL.D.

**DOW'ELL**, STEPHEN (1833-98). An English legal and historical writer. He was born on the Isle of Wight, graduated at Oxford in 1855, studied law at Lincoln's Inn, and in 1863 was appointed by Lord Palmerston Assistant Solicitor to the Board of Inland Revenue, an office which he held until 1896. In addition to numerous legal and historical tracts he was the author of several works on taxation, on which subject he was admittedly for many years one of the highest authorities in England. Among these works are: *The Income Tax Laws* (1874; 3d ed., 1890); *A Sketch of the History of Taxes in England* (1876); *A History of Taxation and Taxes in England, from the Earliest Times to the Present Day* (4 vols., 1885; 1888), the standard work on this subject.

**DOWER** (OF. *doaire*, Fr. *douaire*, Prov. *dotaire*, from ML. *dotarium*, dower, from Lat. *dos*, dower). The common-law right of the wife to a one-third interest for life in the real estate of her deceased husband. It is limited to freehold estates of inheritance, and the character of the holding must be such that the issue of the marriage, if any, might by possibility have inherited it. It extends, therefore, to all estates in fee simple of which the husband was seised at any time during coverture, and to all such fees tail as are limited to the issue of the husband by the wife in question. This interest in her husband's real estate attaches at the moment of marriage or of the subsequent acquisition by the husband of the property, and continues thereafter during the life of the wife, passing through three stages or forms. During the coverture and ownership of the property by the husband, she has an *inchoate* right of dower. This is a mere right or possibility of obtaining the property by surviving her husband. It is a right, however, which the courts will protect, as between her and her husband. He cannot at common law deprive her of it either by a conveyance to a third person or by last will and testament. After the death of the husband, and before she has been put into possession of the specific one-third of his realty which should be set apart for her, she has a right of action for the purpose of obtaining her dower. It is the duty of the husband's heirs, or purchasers, or other persons who may be in possession of the property, to set out or *assign* her one-third to her, and an action lies to compel the performance of that duty. After such assignment has been made, and she has been

given possession of the land, she acquires an interest or estate therein during her own life. Dower attaches to real property only and not to personal property. It is strongly favored by the common law. No act that the husband alone can do will bar it. If he sell real estate to which his wife's dower right is attached without having her unite in the transfer, the purchaser takes subject to such right. It is not necessary that the husband shall be actually in possession of the property in order to give the wife dower therein. The fact that he is seised, during the coverture, in fact or in law, of a beneficial estate of inheritance will be sufficient to support her claim to dower. The wife's common-law right of dower in her husband's real estate is of great antiquity and has analogies in most other systems of law. In our system it has passed through many stages. It is recognized as an indefeasible property right in the coronation oath of Henry I (1100), though at that time and for many years afterward it might be varied by other forms of dower, which are now obsolete, as *dowment at the church door* and *dowment by the father's assent*. These enabled the husband, by a declaration which formed part of the marriage service, to confer on his wife a dower right to the whole, or the half, or any other proportion of his lands which should be acceptable to her, and which on his death she might accept in lieu of the one-third accorded to her by the common law. If at that time she rejected the formal endowment, she was entitled to fall back on her common-law dower. The declaration of the bridegroom in our marriage service, "with all my worldly goods I thee endow," which is now of no legal effect whatever, is a curious survival of this ancient practice.

At a much later period, when the practice of conveying lands in trust, or to the use of others, had become common in England, the common-law right of dower was *displaced* in abeyance, being replaced by a definite provision called a jointure, usually made in lieu thereof. This was rendered necessary by the fact that, under the system of uses, lands were commonly held by those who had only a beneficial interest therein and not the legal title, and there could be no dower in a purely beneficial or equitable estate. Upon the abolition of uses by the Statute of Uses in 1535 (27 Hen. VIII, c. 10) the right of dower revived, and it was expressly provided that the wife might elect between her jointure and her dower, but should not be entitled to both. See **JOINTURE**; **USE**.

Both in England and in many of the United States modern statutes have materially modified the dower rights of the wife. Where dower is preserved by such statutes, the husband is usually given power, by his own act or deed alone, to bar it as to property which he desires to sell during the coverture. In England by the Dower Act of 1833 (3 and 4 Wm. IV, c. 105) dower is barred by any expression of intention by the husband, whether direct or indirect, contained in any deed or will executed by him, that his wife shall not have dower in his lands or any part of them. In some of the United States in which a widow is given the right of inheritance, dower has been wholly abolished.

In most of the older States, however, the common-law dower is still retained. In the absence of statutory changes there are several ways in which dower may be barred. These are: 1. By an absolute divorce. In the absence of statu-

tory qualifications such a divorce bars dower only where it was obtained because of the misconduct of the wife. But in some of the States a dissolution of the marriage tie for any cause ipso facto puts an end to the wife's claim to dower. 2. If the wife join in the deed by which her husband conveys real estate, she thereby releases her dower and is barred from subsequently claiming it. It is in order to secure this result that the wife commonly joins in her husband's conveyance. 3. If the wife induce any one to purchase her husband's real property by representing to him that she has no dower right therein, she will be estopped or precluded from subsequently claiming dower in that property against such purchaser or those who claim under him. 4. If the title of the husband be defeated, either while he lives or after his death, by one who claims under a paramount title, this will also defeat the wife's dower. 5. When, by the exercise of the right of eminent domain, the State takes real estate from the husband and makes compensation to him for it, the wife's right of dower in the property so taken is barred. But she may follow the proceeds and claim her dower in that. So far as the right of dower is still recognized, it extends to equitable as well as to legal estates of inheritance. This has always been the rule in the United States and was made a part of the English law of dower by the Dower Act, above referred to. See HUSBAND AND WIFE; MARRIED WOMAN; and, for the corresponding right of the husband in the inheritable property of the wife, see CURTESY.

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**DOWIE**, dou'ī, JOHN ALEXANDER (1847-1907). The self-styled "First Apostle of the Lord Jesus the Christ, and General Overseer of the Christian Catholic Apostolic Church in Zion"; also, "Elijah II." He was born in Edinburgh, studied in the university there, returned to Sydney, Australia, where his family had gone in 1860, entered the ministry, and was ordained a clergyman of the Congregationalist denomination in South Australia. He was prominent in politics and social reform and in 1878 went into evangelistic work, feeling it was wrong to take a minister's salary. In 1882 he established an independent tabernacle in Melbourne and about this time took up his residence in Chicago. He came to the United States in 1886 and in 1896 organized his "church," which in 1901 was established at Zion City—so named by him—on the shore of Lake Michigan, 42 miles north of Chicago. In 1903 Dowie led his "hosts" to New York City to regenerate the metropolis. In 1906 Zion City revolted against him and finally suspended him from the church, charging him with misuse of investments, tyranny, polygamous tendencies, and other offenses. Consult Harlan, *John Alexander Dowie and the Christian Catholic Apostolic Church* (Evansville, 1906), a University of Chicago doctoral dissertation, and E. Sheldrake (ed.), *The Personal Letters of John Alexander Dowie* (Zion City, 1912).

**DOWITCHER**, dou'ich-ēr (corruption of Ger. *deutsch*, German, or Dutch *duitsch*, Dutch). A popular name for certain shore birds. They constitute the genus *Macrorhamphus*, are closely related to the snipes (q.v.), and are often called gray snipe, or red-breasted or red-bellied snipe. The bill is distinctly snipelike, but the tail and feet are like those of sandpipers. Two species are recognized, but during the migrations one species (*Macrorhamphus griseus griseus*) is found along the Atlantic coast of the United States, while the other, the long-billed (*Macrorhamphus griseus scolopaceus*), migrates through the Mississippi Valley and Western States. The dowitchers are about 10 or 12 inches in length, with a bill 2 to 2½ inches long. The upper parts are chiefly black or blackish (in winter, brownish gray), and the under parts dull pale rufous, more or less marked with black. See Plate of BEACH BIRDS.

**DOW'LAS** (probably from *Doullens*, a town of France). A coarse, strong unbleached linen, much used in the sixteenth century and said to have been made at Doullens, France. It was largely manufactured in southern Scotland and in Yorkshire in the eighteenth century and used by working people for shirts and aprons. The term is also applied to a cotton cloth finished to imitate linen.

**DOW'LER**, BENNET (1797-1879). An American physician. He was born in Moundville, Va., graduated at the medical school of the University of Maryland, and in 1836 settled in New Orleans, where he founded the Academy of Sciences and for some years edited the *New Orleans Medical and Surgical Journal*. His experiments resulted in valuable discoveries in contractibility, calorification, and capillary circulation. He wrote a *Tableau of the Yellow Fever of 1853* (1854).

**DOW'LING**, JOHN (1807-78). An American Baptist clergyman. He was born at Pevensey, Sussex, England, and settled in the United States in 1832. He wrote *History of Romanism* (1845; revised 1871), and many other works.

**DOWN**. A maritime county in the southeast of Ulster Province, Ireland (Map: Ireland, F 2). Area, nearly 950 square miles. It has a low, rocky coast line of 67 miles, or 125 by the inlets, skirted by many islets. The Mourne Mountains cover 90 square miles in the south and rise 2796 feet in Slieve Donard. Several other peaks exceed 2000 feet. Mineral springs occur frequently. Miraculous healing powers were believed to be possessed by the springs near Downpatrick, where extravagant religious demonstrations occurred until 1849. The chief crops are oats, potatoes, and turnips. The cultivation of flax, once an important product, has been practically abandoned. Many hogs are raised. The chief manufacture is linen, especially the finer fabrics, such as muslin, woven in the houses of the small farmers. Hosiery, leather, salt, thread, and woollens are also made. These, with corn, butter, pork, and hides, are the chief exports. Capital, Downpatrick. Pop., 1841, 368,200; in 1891, 219,405; 1901, 205,889; 1911, 204,303.

**DOW'NCAST**. Where mines have two or more shafts or openings, the downcast shaft is the one through which the fresh air from the surface enters the workings. When ventilation

is not forced by using a fan or stove, the direction of the ventilating current changes with the seasons or temperature of the outside air. In the winter, or when the temperature of the outside air is much lower than the temperature of the mine air, the shaft having the lowest elevation will be the downcast and vice versa.

**DOWNERS GROVE.** A village in Dupage Co., Ill., 21 miles by rail west of Chicago, on the Chicago, *Peoria and Quincy Railroad* (Map: *Ill.*). It contains a public library. The chief manufactures are electric linemen's tools and furniture, and there are large dairy and greenhouse interests. The water works and electric-light plant are owned by the village. Pop., 1900, 2103; 1910, 2601.

**DOWNING, ANDREW JACKSON** (1815-52). An American nurseryman, landscape gardener, and pomologist, born at Newburgh, N. Y. His influence upon American horticultural development is probably unsurpassed. To him must be accredited the introduction and development of the free school of landscape gardening in *the United States*. He planned the grounds about the National Capitol, the White House, and the Smithsonian Institution in Washington, D. C. To his foresight, and to his spirit as communicated to others, we owe our present American system of broad free municipal parks. Downing's monumental work, *Fruits and Fruit Trees of America* (1845), greatly extended by his brother Charles (q.v.), together with his numerous essays, forms the bulk of his contribution to the literature of horticulture. Another important work is the *Treatise on the Theory and Practice of Landscape Gardening* (1841). These essays were first published in the *Horticulturist*, of which he was editor at the time of his death, and afterward in book form under the title of *Rural Essays* (1854), for which book George William Curtis wrote a memoir of Downing. He was drowned while attempting to save the lives of others on the burning Hudson River steamer *Henry Clay*.

**DOWNING, CHARLES** (1802-85). An American nurseryman, the elder brother of A. J. Downing (q.v.). He was born at Newburgh, N. Y. He was one of those who put nursery gardening on a scientific basis. In fact, his nursery became so much of an experiment station that after the death of his brother, with whom he had collaborated, he abandoned commercial horticulture and devoted himself for the remainder of his life to the amplification and revision of *The Fruits and Fruit Trees of America*. His efforts more than doubled the original scope of the volume and made him until his death a recognized authority throughout the world on all questions pertaining to pomology, horticulture, and tree growth.

**DOWNING, SIR GEORGE** (c.1623-84). An English soldier and politician. He was born in Dublin and was the nephew of Gov. John Winthrop, who induced him to study at Harvard College, from which he graduated as a member of its first class (1642). Some years afterward he went to England and served in the parliamentary army. During the Protectorate he was a member of both parliaments, was a leader of the movement for offering the crown to Cromwell, and in 1655 was sent to France to protest against the Vaudois massacre. In 1657 he became British resident at The Hague. He ingratiated himself with the exiled Stuarts, however, and after the Restoration was instrumental

in arresting three regicides. He was knighted in 1660 and made a baronet in 1663 and became Secretary of the Treasury and one of the Commissioners of Customs. Downing Street, Whitehall, derives its name from him. Pepys called him a "perfidious rogue," and in New England his name became a synonym for a traitor.

**DOWNING COLLEGE.** A college of Cambridge University, founded by Sir George Downing, of Gamlingay Park, Cambridge, who died in 1749, leaving his estates to be appropriated to the founding of a college in Cambridge after various trust provisions had expired. The succession on which the trust depended dying out, a charter was obtained in 1800 for a college devoted especially to the study of law and medicine, for a master, two professors, and 16 fellows. The original scheme was straitened by costly litigation, and only two sides of the quadrangle have so far been completed. The statutes were framed in 1805 and altered in 1860. The college had, in 1913, a master, 12 fellowships, restricted to law and medicine, and 23 scholars. In 1913-14 there were 116 undergraduates. Consult H. W. Stevens, *Downing College* (London, 1899).

**DOWNING STREET.** A street in the South West district of London, leading from Whitehall. The Foreign Office and Colonial Office are located in it, and the name is used as a convenient synonym for the central powers of the British government.

**DOWNINGTOWN.** A borough in Chester Co., Pa., 33 miles west of Philadelphia, on the Pennsylvania and the Philadelphia and Reading railroads (Map: Pennsylvania, K 8). It has paper mills, brickyards, a knitting mill, and machine shops. Pop., 1900, 2133; 1910, 3326.

**DOWNPATRICK, or DOWN.** A municipal borough and cathedral town in the County of Down, Ireland, of which it is the capital (Map: Ireland, F 2). It is situated near the mouth of the Quoyle, at the end of Lough Strangford, 21 miles south-southeast of Belfast, with which town it is connected by railway. The cathedral in its present form was restored in 1790 on the site of one built in 1412 and burned in 1538. Vessels of 100 tons reach the quay a mile from Downpatrick. It has manufactures of linen, muslins, soap, leather, and malt liquors. Pop., 1901, 2993. Downpatrick is believed to be the oldest town in Ulster Province. It was the residence of the kings of Ulster and was famous before the arrival of St. Patrick, who built near here the Abbey of Saul and the Abbey of Canons and by some is believed to have been buried here. Consult *Ecclesiastical Associations of Downpatrick* (Belfast, 1897).

**DOWNS** (AS., OHG. *dūn*, Ger. *Düne*, Fr. *dune*, from Ir. *dūn*, Welsh *din*, hill, fort; ultimately connected with AS. Icel. *dún*, Eng. *town*, OHG. *zūn*, Ger. *Zaun*, hedge). A term usually applied to hillocks of sand thrown up by the sea or the wind along the seacoast. It is also a general name for any undulating tract of upland too light for cultivation and covered with short grass. It is especially applied to two broad ridges of undulating hills in England south of the Thames, beginning in the middle of Hampshire and running eastward, the one (the North Downs) through the middle of Surrey and Kent to Dover (about 120 miles), and the other (the South Downs) through the southeast of Hampshire and near the Sussex coast to Beachy Head (about 80 miles). The highest point of the North Downs is Botley Hill, 880 feet, and that

of the South Downs, Ditchelling Beacon, 858 feet. These uplands are covered with fine pasture, forming excellent feeding ground for the famous Southdown sheep. The valleys among the hills are usually fertile and admit of cultivation, so that an excellent field is furnished for mixed husbandry.

**DOWNS, THE.** An important English roadstead off the east coast of Kent, between Ramsgate and Deal, with a maximum depth of 12 fathoms, affording harborage except during heavy south winds (Map: England, G 5). It is protected externally by the Goodwin Sands, a natural breakwater with 1 to 4 fathoms of water, and often partly dry at low tide. It is defended by Deal, Dover, and Sandown castles. The Downs were the scene of a victory of the Dutch over the Spaniards in 1639 and of a naval battle between the Dutch and English in 1666.

**DOWNY MILDEW.** See MILDEW; PHYCOMYCETES.

**DOWRY** (from *dower*, AS. *dowere*, OF. *doaire*, Fr. *douaire*, Prov. *dotaire*, from ML. *dotarium*, from Lat. *dos*, dowry; connected with Lat. *dare*, Gk. *διδόναι*, *didonai*, Skt. *dā*, to give). The property which the wife brings to the husband, as her marriage portion. Though recognized at the common law and often forming in England an important element in the arrangement known as a marriage settlement, it is scarcely known in the United States, except in Louisiana. There, as in most countries which have adopted the system of the civil law, it constitutes a distinct as well as an important form of property. It is given to the husband, who has exclusive control and administration of it during marriage, to be employed in defraying the expenses of the family. The wife cannot deprive the husband of its control. On the other hand, he is not allowed to alienate real estate which comes to him as dowry. In the United States and England property so contributed by the wife to the common fund, though legally vested in the husband, may be protected by him from the claims of his creditors. Dowry is to be distinguished from dower, or the common-law right of the wife in the real estate of her husband, with which it is sometimes confounded. See DOWER.

**DOWSING.** See DIVINING ROD.

**DOXOL/OGY** (ML. *doxologia*, Gk. *δοξολογία*, from *δόξα*, *dōsa*, glory, from *δοκεῖν*, *dōkein*, to seem + *-λογία*, *-logia*, speech, from *λέγειν*, *legein*, to say). An ascription of glory or praise to God. Brief expressions of the kind are frequent in the Bible, as Rom. xvi. 27; Eph. iii. 21; Jude 25; Rev. v. 13, xix. 1. Certain special doxologies are used in various liturgies. The Lesser Doxology, or *Gloria Patri* ("Glory be to the Father, and to the Son, and to the Holy Ghost; as it was in the beginning, is now, and ever shall be, world without end, amen"), seems first to have come into use in the fourth century, as a profession of faith, in opposition to a variant formula, which had been appropriated by the Arians. It is used by the Roman Catholic church at the end of every psalm and canticle, except the *Te Deum* and *Benedicite*, and in all the responsories of the breviary. It is omitted, however, as a song of praise unsuitable to times of mourning, on the last three days of Holy Week and in the office of the dead. The Anglican church uses it at the end of psalms and canticles. The use of the **Greater Doxology**, or *Gloria in Excelsis* (sometimes called the angelic

hymn, from its being an expansion of the song of the angels in Luke ii. 14), can be traced back to the fourth century, and it appears in the Roman liturgy at the beginning of the sixth century. It is used in the Roman mass, except in Advent and Lent, and at all times in the Anglican communion service. The **Trisagion** ('thrice holy') is the seraphic hymn (Isa. vi. 3). The last stanza of a hymn written by Bishop Thomas Ken (1637-1711), beginning, "Praise God from whom all blessings flow," is commonly called "the Doxology" in Protestant churches.

**DOYEN**, dwā'yān', EUGÈNE LOUIS (1859- ). A French surgeon, born in Rheims (Marne), and noted for his discoveries in surgery and his investigations in cancer. After introducing numerous innovations in general and surgical technique, he established in Paris in 1895 a private clinic, which soon became a centre of study for both French and foreign surgeons. His improvements in surgical methods were quickly adopted, and he became a leader in the new French school of surgery. He claimed to have discovered the germ of cancer, but this claim has not been substantiated by other investigators. In 1898 he received the degree of LL.D. from Edinburgh University, where he applied the method of teaching surgery by means of the cinematograph. Among his publications are: *Traitément de cancer* (1904); *La maladie et le médecin* (1906); *Traité de thérapeutique chirurgicale et de technique opératoire* (1907); *Le cancer* (1909).

**DOYEN, GABRIEL FRANÇOIS** (1726-1806). A French historical painter. He was born in Paris and studied under Van Loo. After obtaining the Prix de Rome (1748) he remained for several years in Italy, studying the works of Carracci, Cortona, and other celebrated masters. In 1767 he produced his celebrated painting, the "Miracle des Ardens" (Saint-Roch, Paris), which was followed by the "Death of St. Louis" (Saint-Eustache, Paris); "Triumph of Amphitrite" (Louvre); "Adoration of the Magi" (Darmstadt Museum); and paintings in St. Gregory's Chapel in the Invalides (Paris). All of these compositions are in the style of the late eighteenth century and, though effective, are cold in color. In 1791 he was called to St. Petersburg, where he was charged by Catharine II and Paul I with decorations for the Winter Palace and the Old Hermitage.

**DOYLE, ALEXANDER** (1857- ). An American sculptor. He was born at Steubenville, Ohio, and studied at the academies of Florence, Carrara, Rome, and Paris. He is at his best in large monumental and military figures, such as the bronze equestrian statues of the Confederate Generals Johnson and Lee at New Orleans; the monument to Francis Scott Key at Frederick, Md.; the bronze statue of Horace Greeley in New York City; the statues of Senators Thomas Benton, Franklin P. Blair, and John E. Kenna in the United States capitol; General Garfield in Cleveland, Gen. Philip Schuyler on the National Revolutionary Monument, Saratoga; the statue of "Peace" on the Revolutionary Monument at Yorktown; and the Soldiers' Monument at New Haven. Among more recent works are the statue of E. M. Stanton, Steubenville, and the equestrian statue of General Beauregard, New Orleans.

**DOYLE, SIR ARTHUR CONAN** (1859- ).

A British novelist, born in Edinburgh, the grandson of John Doyle the caricaturist, and nephew of Richard Doyle of *Punch*. He studied medicine at the University of Edinburgh, and was a practicing physician from 1882 until 1890. He traveled extensively in the Arctic regions and on the west coast of Africa. He early tried his hand at fiction, and, after writing a number of unsuccessful books, he produced in 1887 *A Study in Scarlet*, in which he created the famous detective, Sherlock Holmes. Other books of his in which Holmes appears are: *The Sign of the Four* (1889); *The Adventures of Sherlock Holmes* (1891); *The Memoirs of Sherlock Holmes* (1893); *The Hound of the Baskervilles* (1902); *The Return of Sherlock Holmes* (1904). In these stories the author displays rare fertility and ingenuity of invention, humor, and a power of imbuing his narrative with an atmosphere of fascinating mystery and, at times, of horror; so that the best of the stories approach the similar productions of Edgar Allan Poe. Doyle also won much success by several historical novels: *Micah Clarke* (1888); *The White Company* (1890); *The Refugees* (1891); *The Great Shadow* (1892); *Rodney Stone* (1896); *The Exploits of Brigadier Gerard* (1896). *The Adventures of Gerard* (1903) is an exceedingly clever book, of which the hero is a typical *vieux moustache* of Napoleon's Grand Army. *Sir Nigel* (1906) is considered by many critics his best production in historical fiction. Volumes of short stories are: *Round the Red Lamp* (1894); *The Stark Munro Letters* (1895); *The Green Flag and Other Stories* (1900). In 1898 appeared a volume of poems entitled *Songs of Action* and in 1899 a play called *Halves*. Other works are *The Tragedy of the Korosko*, a story of the Egyptian Soudan (1898), and *A Duet with an Occasional Chorus* (1899). During the Boer War Doyle visited South Africa and acted as senior physician of the Langman Field Hospital. Returning to England, he published a military history, entitled *The Great Boer War*, which appeared in 1900 and of which an enlarged edition was issued in 1902. He also wrote *The Cause and Conduct of the War* (1903), a spirited defense of the British policy in South Africa, and this was widely circulated and translated into 12 languages. As a recognition of his services to the government, the author was knighted in 1902. Later publications of his are: *The Crime of the Congo* (1910); *The Lost World* (1912); *The Poison Belt* (1913).

**DOYLE, SIR FRANCIS HASTINGS CHARLES** (1810-88). An English poet. He was born at Nunappleton, near Tadcaster, and was educated at Oxford. From 1867 to 1877 he was professor of poetry at Oxford. He published several books of verses, his poetic work being chiefly remarkable for his treatment of the ballad. His publications include: *Miscellaneous Verses* (1834; reprinted with additions in 1840); *Two Destinies* (1844); *Return of the Guards and Other Poems* (1866); and his *Reminiscences* (1866).

**DOYLE, JOHN** (1797-1868). An Irish painter and caricaturist, born in Dublin. He studied first under Gabrielli, then at the Royal Dublin Society's schools, and afterward under the miniature painter Cumerford. In 1821 he came to London, and some of his portraits were exhibited at the Royal Academy, but without much success. He then turned his at-

tention to caricature and also worked in lithography. For many years (1828-50) he published a series of monthly political sketches, signed "H. B.," which were usually commented upon in the London *Times*. His identity remained unknown until 1850. His satire was very different from that of his coarse and violent, if vigorous, predecessors. He was always refined, never tending towards burlesque, and established what may be called a gentlemanly style of caricature. Thackeray, Macaulay, Haydon, and Wordsworth have praised his work, and his sketches throw much light on the political history of England between the years 1830 and 1845, for every man of note in political England became known through his pencil. There are more than 600 examples of his work in the British Museum, including 314 of the original designs of his 917 *Political Sketches*. One of his most important designs is the drawing for "The Reform Bill Receiving the King's Assent by Royal Commission" (1836), engraved by Walker and Reynolds. He also published *The Life of the Race Horse* (1822, 6 plates).

**DOYLE, JOHN ANDREW** (1844-1907). An English writer of American history, the son of Andrew Doyle, editor of the *Morning Chronicle*. He was educated at Eton and at Balliol College, Oxford, where he took his M.A. degree in 1869, winning the Arnold Prize Essay on the subject of *The American Colonies*, which, when published the following year, attracted wide attention as a defense of the American Revolution by an Englishman. He became a fellow of All Souls in 1869. His later works were *A History of the United States* (1875) and *The Republic of America—Virginia, Maryland, and the Carolinas* (1882), "The Puritan Colonies" (2 vols., 1887), "The Middle Colonies" (1907), and "The Colonies under the House of Hanover" (1907); and he contributed valuable chapters to the seventh volume of the *Cambridge Modern History*. His *Essays on Various Subjects* was published posthumously (London, 1911), ed. by Ker, with introduction by Sir W. Anson; it includes several articles on sport-rifle shooting, the turf, racehorse breeding, and harriers—as well as valuable historical and critical essays.

**DOYLE, RICHARD** (1824-83). An English water-color painter and caricaturist, born in London in September, 1824. He was the son and pupil of John Doyle, from whom he inherited his talent. Its early development is proved by a sketchbook of 1840 in the British Museum, a facsimile of which was published in 1885. Doyle was one of the early contributors to *Punch*, but resigned his position on the staff in 1850 because of that journal's hostile attitude towards the Catholics. "What has become, with slight permanent cover of the journal. He furnished illustrations for Thackeray's *The Newcomes*, Ruskin's *King of the Golden River*, Leigh Hunt's *Pot of Honey*. The best known of his humorous stories, told in pictures, are the "Adventures of Brown, Jones, and Robinson" and "Mr. Pip's Diary," originally contributed to *Punch*. The British Museum, the Fitzwilliam Museum, Cambridge, National Gallery, Dublin, and National Portrait Gallery, Edinburgh, are rich in his caricatures, which are distinguished by genial humor and graceful drawing. He also exhibited many water colors in the Grosvenor Gallery, among the best of which were "Under the Dock Leaves" and two Scottish landscapes (British

Museum); "Wood Elves Watching a Lady" (South Kensington Museum); "Thor" (Fitzwilliam Museum, Cambridge); "The Triumphant Entry," a fairy pageant (National Gallery, Dublin).

**DOYLESTOWN.** A borough and the county seat of Bucks Co., Pa., 34 miles north of Philadelphia, on the Philadelphia and Reading Railroad (Map: Pennsylvania, L 7). It has a public library, fine courthouse, and county historical society. The industries comprise a shoe factory, hosiery, silk, and worsted mills, creameries, saw and flour mills, agricultural-implement works, brick and tile works, a spoke factory, and foundry. The water works are owned by the borough. Pop., 1900, 3034; 1910, 3304.

**D'OYLY, GEORGE** (1778-1846). A Church of England divine. He graduated B.A. at Cambridge, became rector in London (1820), and was one of the principal promoters of the establishment of King's College, London. He is chiefly remembered as joint author with Richard Mant of D'Oyly and Mant's Bible, an annotated edition of the Bible published by the Society for Promoting Christian Knowledge (1814 and often since). Consult his *Memoir* by his son (London, 1847).

**DÓZSA, dō'zhō, GEORGE** (?-1514). The leader of the Peasant War in Hungary (1514), sometimes called Székely. At the head of a large army (estimated by some at 60,000 men) originally designed for a crusade against the Turks, Dózsa led a rebellion in the course of which many excesses were committed. While his army lay before Temesvár, which came near falling into his hands, Dózsa was taken prisoner. His forces were dispersed, he was roasted alive on a heated throne, and his body was fed to some of his followers who had been kept without food during the preceding week. The rebellion is the theme of the novel by Eötvös entitled *Magyarország 1514-ben* (1847; Ger. trans. by Dux under the title *Der Bauernkrieg in Ungarn*, 1850). There is a play by Marki. (Budapest, 1884) by Marki.

**DOZY, dō'zē, REINHART** (1820-83). A noted Orientalist, descended from a French family settled in Holland, and born at Leyden. He pursued a course of study at the University of Leyden and obtained the doctor's degree in 1844. Until 1850 he was at the University of Leyden, where he was made assistant professor, and in 1857 full professor, of history. His first important work was published in Amsterdam (1845), under the title *Dictionnaire détaillé des noms des vêtements chez les Arabes*. In 1846 appeared the *Scriptorum Arabum loci de Abbadidis* and the *Commentaire historique sur le poème d'Ibn Abdoun par Ibn Badroun*. Among his other works are: *History of the Almohades* (1847; 2d ed., 1881); *Histoire de l'Espagne* (1848; supplement, 1849); *Sur l'histoire et la littérature de l'Espagne pendant le moyen âge* (1849; 3d ed., 1881); *Al Makkari, Analectes sur l'histoire et la littérature des Arabes d'Espagne* (1855-61); *Histoire des Musulmans d'Espagne jusqu'à la conquête de l'Andalousie par les Almoravides* (1861); *Het Islamisme* (1863); *De Israëlieten te Mekka* (1864). His most important contribution to Arabic philology was his *Supplément aux Dictionnaires Arabes* (2 vols., 1877-80), which is invaluable to all students of Arabic and is based on an exceed-

ingly extensive study of Arabic authors of all classes. Consult De Goeje, *Biographie de Reinhart Dozy traduit par Chauvin* (1883).

**DRA, drā.** A partially dried-up river or wadi, of southern Morocco, Africa, the longest watercourse of the country (Map: Africa D 2). It rises in numerous head streams on the south slopes of the Central Atlas Range, and after crossing the oasis of Ed Dra flows southwest, emptying into the Atlantic just south of Cape Nun. It is only, however, by the aid of the melted snow of the Atlas summits that its waters are sufficiently increased to be enabled to reach the ocean; in the dry season its course ends a long distance from the coast.

**DRACENA DRACO** (Lat., from Gk. δράκαινα, *drakaina*, she dragon, from δράκων, *drakōn*, dragon), or **DRAGON TREE.** A tree of the family Liliaceae, that produces the resin called dragon's blood. Its thickness is greatly out of proportion to its height. The head is crowned with short branches bearing tufts of sword-shaped leaves. Humboldt saw a famous specimen in Teneriffe, which at the time of his visit was 70 feet tall and 45 feet in circumference and was estimated to be 6000 years old. It was destroyed by a storm in 1868. Others of large size are reported from the Canary Islands and India. Another source of dragon's blood is the resinous exudate from the fruit of *Calamus draco*. Similar substances are obtained from *Lingoum draco* and *Oroton gossypifolius*.

**DRACHENFELS, drā'en-fēls** (Ger., Dragon's Rock). A mountain of Prussia, in the Siebengebirge Range (q.v.), situated on the right bank of the Rhine, about 8 miles southeast of Bonn, with an elevation of 1066 feet (Map: Prussia, B 3). It rises abruptly from the river and is covered with brushwood almost to the top, whence the prospect is magnificent, extending down the river as far as Cologne, and having a charming foreground in Bonn, with its University and numerous old and time-worn castles. About half way up the mountain is the cave which, according to the legend, was occupied by the dragon slain by Siegfried. Of the mediæval castle of Drachenfels, erected on the summit of the mountain, only a solitary tower remains. The mountain, which has been extensively quarried, is the property of the state and can be ascended by rail.

**DRACHMA, drāk'ma, DRACHM, drām, or DRAM** (Lat., from Gk. δραχμή, *drachmē*, handful, from δράσσειν, *drassein*, to grasp). The name of a Greek measure of weight and of a Greek coin. The measure of weight was equal to six small bars of silver (δραχμοί) or a handful (this ancient explanation has, however, been questioned in modern times); 100 drachmas formed a mina and 6000 a talent. The weight varied somewhat in different places and at different times, but, as used in trade, seems to have been from 6 to 6.5 grams. The silver coin called drachma was the ordinary unit of the ancient Greek monetary system. Here also there were local differences; but two main systems are clearly marked—the Æginetan, with a drachma of about 6.3 grams, or frequently somewhat less; and the Eubœic-Attic, with a drachma of about 4.3 grams of pure silver, or about 18 cents in the United States standard coinage. Thus, the Attic mina was worth about \$18 and the Attic talent about \$1080. The drachma is also the name of the monetary unit in modern Greece. Since 1867, when Greece joined the Latin Union,



it has been of the same weight and fineness as the French franc. In the British system of weights there were, till recently, two drachms or drams—the avoirdupois dram, equal to 27 $\frac{1}{4}$  troy grains, and the apothecaries' dram (not now used), equal to 60 troy grains, or  $\frac{1}{8}$  of an ounce troy. See Plate I of NUMISMATICS.

**DRACHMAN**, drāk'mān, BERNARD (1861–). An American rabbi and author, born in New York City. He graduated at Columbia in 1882, studied at Heidelberg and Breslau, and became a rabbi in Breslau in 1885. In 1887 he was appointed professor of biblical exegesis and Hebrew philosophy in the Jewish Theological Seminary of New York, and in 1889 dean of the seminary and rabbi of the Congregation Zichron Ephraim, and from 1902 to 1908 was professor of Bible and Rabbinical codes. In 1909 he became rabbi of the Congregation Ohab Zedek. He consistently supported the traditional Judaistic faith. His publications include: *Die Stellung und Bedeutung des Judentums in der Geschichte der hebräischen Nation* (1885); *From the Heart of Israel: Jewish Tales and Types* (1905); a translation into English (1899) of S. R. Hirsch's German work, *The Nineteen Letters of Ben Uziel*.

**DRACHMANN**, drāc'mān, HOLGER (1846–1908). Danish poet, playwright, and novelist, born in Copenhagen. He studied art, but in 1877 wrote *From over the Border*. The modern movement in Danish literature dates from his *Poems* (1877), and his novels of seafaring life, *On a Seaman's Word and Honor* (1878) and *Paul and Virginia under Northern Latitudes* (1879). His poems include: *Subdued Melodies* (1878); *Old Gods and New* (1881); *Mountain Songs and Romances* (1885); *Motley Leaves* (1901). He wrote many fairy plays, including *Once upon a Time* (1885), which was very successful, and melodramas, *Brav-Karl* (1897); *Green Hope* (1901). Among his novels are: *With a Broad Pencil* (1887); *Prescribed* (1890); *Dædalus* (1900).

**DRA'CO** (Lat., from Gk. Δράκων, *Drakōn*). An Athenian legislator. It was he who, as Thesmothete, in 621 B.C. put into written and codified form the common law of Athens. To a later age this legislation bore the stamp of severity and cruelty, it being said of the laws that they were written, not in ink, but in blood. In every case, no matter what the offense, the penalty was death. We are not, however, to assume that Draco was more severe than his age; it is more probable that he simply put in writing the ordinances that the archons had been accustomed to enforce without writing, and the old Attic common law, when thus reduced to writing, appeared harsh and rigorous to a milder age. Connected with the legislation was the court of appeal, the Ephetae, judges of life and death, whose number was 51. These laws, except those on homicide, were repealed by Solon. Draco is said by Suidas to have met his death at Ægina, being stifled in the theatre by the garments thrown upon him by the people as a mark of respect, and approval of his act in reducing the laws to writing. Consult Holm, *Griechische Geschichte*, vol. i (Berlin, 1886).

**DRA'CO**. A northern constellation situated just below the celestial pole. It contains the pole of the ecliptic. The star  $\gamma$  Draconis is celebrated as the one used by Bradley (q.v.) in discovering the aberration of light (q.v.). It is a bright star, nearly in the solstitial colure,

and consequently the minor axis of the small aberrational ellipse, which its apparent place describes in the heavens, lies in the meridian at its transit. Moreover, at the two equinoxes, when its apparent place is at the extremities respectively of this minor axis, it can be observed on the meridian at one equinox about sunrise and at the other about sunset, so that both observations may be made without the interference of a too bright daylight. These two observations therefore are easily taken, and the difference in the north polar distance which they give is the minor axis of the ellipse described by the apparent place of the star.

**DRA'CONTIC MONTH**. See MONTH.

**DRACONTIUM**, drā-kōn'shī-ūm. See SKUNK CABBAGE.

**DRACONTIUS**, drā-kōn'shī-ūs, BLOSSIUS ÆMILIUS. A Latin poet who lived and practiced as an advocate at Carthage during the latter half of the fifth century. Though his style is often spoiled by rhetorical exaggeration, his verses are framed on classical models and are of considerable merit; they prove also his familiarity with the Bible and with classical Latin writers. His extant works are two epithalamia; a collection of short epics on subjects taken from mythology; a Christian didactic poem in three books, entitled *De Laudibus Dei* (part of book i, containing an account of the story of the creation, was at an early date edited separately under the title *Hewæmeron*); an elegiac poem, *Satisfactio*, in which he apologizes to the Vandal King, Gunthamund (484–496 A.D.), for having praised one of his enemies; and several distichs, *De Origine Rosarum* and *De Mensibus*. Owing to resemblance in style and metre to the practice of Dracontius, the *Orestis Tragedia*, formerly attributed to Horace or Lucan, is now generally ascribed to Dracontius. Dracontius was edited by Arevalo (Rome, 1791). The *Carmina Minora* of Dracontius were edited by De Duhn, some of them for the first time (Leipzig, 1873). The *Orestis Tragedia* has been edited by Peiper (1875) and Giarratino (Milan, 1906). Consult also Rossberg, *De Dracontio* (Göttingen, 1880).

**DRACUT**. A town in Middlesex Co., Mass., 4 miles west of Lowell (Map: Massachusetts, E 2). It is in an agricultural region and has woolen mills. The water works are owned by the town. Pop., 1900, 3253; 1910, 3461.

**DRAESEKE**, drā'se-ke, FELIX AUGUST BERNHARD (1835–1913). A German composer, born in Coburg. He studied at the Leipzig Conservatory under Rietz and became a friend and pupil of Liszt at Weimar. He taught in the Lausanne Conservatory, the Royal Music School at Munich, and in 1884 became a teacher in the Dresden Conservatory. Although at first an extreme follower of Wagner and Liszt, his later works are more moderate and have met with the success due them. His compositions include five operas—*Sigurd* (1867); *Gudrun* (1884); *Bertrand de Born*; *Merlin* (1906); *Herrat* (1892); three symphonies and much excellent chamber music. His importance rests upon his great vocal works with orchestra, a mass in F $\sharp$  m., a *Requiem* in B m., the Easter scene from Goethe's *Taust*, and his great Mystery *Christus* (a cyclus of three oratorios preceded by an elaborate Prelude). Consult H. Platzbecker, *Felix Draeske*, in vol. iii *Monographien Moderner Musiker* (Leipzig, 1909).

**DRAFT** (variant of draught, from AS.



*dragan*, Icel. *draga*, Goth. *dragan*, to draw, OHG. *tragan*, Ger. *tragen*, to carry). A popular synonym of bill of exchange, or of a check drawn by one bank on another. It is also less commonly applied to a non-negotiable order for the payment of money. Sometimes this form of draft is intended to operate as a written authority to the payee to collect the amount of the order from the drawee for the benefit of the drawer; at other times, as a voucher or warrant for payment by a disbursing officer. See BILL OF EXCHANGE; CHECK; NEGOTIABLE INSTRUMENTS.

**DRAFT RIOTS IN NEW YORK.** A bloody disturbance which took place on July 13-16, 1863. The pressing need for more soldiers had compelled Congress to pass a conscription act (March 3, 1863), authorizing the President to recruit the army whenever necessary by a draft from "all able-bodied male citizens" between the ages of 20 and 45 years. Any man, however, might, after being drafted, procure exemption from service by the payment of \$300. The act was vigorously assailed as unconstitutional by the opponents of the administration, who also asserted that the exemption clause was a flimsy device for enabling the rich to evade service. Among those who adopted and proclaimed such views was Governor Seymour, of New York State, who seems also to have represented the attitude of many prominent men in New York City. On Saturday, July 11, the draft began, without opposition, in New York at one of the enrollment offices in the strongly Democratic Ninth District. On Sunday some drafted workingmen, aided by a number of political agitators, fomented the discontent of the populace and organized an opposition to enrollment. The draft was renewed at 10 A.M. on Monday, but the assistant provost marshal's office was soon attacked, demolished, and burned by a furious mob, which, after overcoming a squad of police sent against it, roamed about the city and, frenzied by excitement and drink, committed numberless outrages. The rioters, prejudiced against the negro and feeling that the draft had been occasioned by an "abolition war," everywhere pursued the blacks with unrelenting rancor and brutally assaulted, tortured, and killed many that fell into their hands. The Colored Orphan Asylum was attacked, sacked, and burned, and the offices of the New York *Tribune*, one of the papers which had upheld the administration, narrowly escaped destruction. On Tuesday the mobs, increased in number, continued to pillage, sack, burn, and kill, though in many districts they were sharply repulsed and partially dispersed by the police and militia. On Wednesday, the 15th, the assistant provost marshal general announced that the draft would be temporarily suspended, and militia regiments arriving from Pennsylvania rendered efficient service against the mobs. Large militia reinforcements arrived on the following day, and, though isolated bodies of rioters still defied the law, order was soon restored throughout the city. Before Friday morning the uprising had been suppressed. It is estimated that during these four days more than 1000 men had been killed, and property valued at over \$1,500,000 had been destroyed.

On August 19 the draft was resumed, and it was completed, without further resistance, within 10 days. Consult: the *Official Records*, vol. xxvii, part ii (Washington, 1889); Fry, *New*

*York and the Conscription of 1863* (New York, 1885); Barnes, *The Draft Riots in New York* (ib., 1863); Nicolay and Hay, *Lincoln*, vol. vii (ib., 1890); Greeley, *The American Conflict*, vol. ii (Hartford, 1866).

**DRAGA.** Queen of Serbia and wife of Alexander I, with whom she was assassinated in 1903. See SERBIA.

**DRAGE**, drāj, GEOFFREY (1860- ). An English sociologist, educated at Eton, Christ Church (Oxford), Berlin, and Moscow. He studied law at Lincoln's Inn and Middle Temple, but did not practice. In 1891-94 he was secretary of the Royal Commission on Labor, and he was a prominent delegate to the Milan Congress on Accidents (1894), the Brussels Congress on Housing of Working Classes (1897), and the Paris Congress on Poor Laws and Charity (1900). In 1895-1900 he was a Conservative member of Parliament for Derby. He published: *The Criminal Code of the German Empire* (1885); *Eton and the Empire* (1890); *Eton and the Labor Question* (1894); *The Unemployed* (1894); *The Problem of the Aged Poor* (1895); *The Labor Problem* (1896); *Russian Affairs* (1904); *Trade Unions* (1905); *Austria-Hungary* (1909); *The Imperial Organization of Trade* (1911), the first of a series on Imperial organization; *The State and the Poor* (1914). He wrote on recent Russian history in the *Cambridge Modern History*.

**DRAG HUNT.** See HUNTING.

**DRAGO**, LUIS MARÍA (1859- ). An Argentinian jurist and diplomat. First devoting himself to criminal law and criminology he wrote *Antropología criminal* (2d ed., 1888) and another book, best known by its version into Italian (1890), called *I criminali-nati*. In 1902 and 1903, as Minister of Foreign Affairs for the Argentine Republic, he formulated the so-called "Drago doctrine." (See CALVO.) His definite statement of this doctrine appeared in his *Cobro coercitivo de deudas públicas* (1906); and he wrote *La república Argentina y el caso de Venezuela* (1903). As a member of The Hague Court, he dissented from the court's decision on question 5 in the Fisheries Arbitration of 1908-09.

**DRAGO DOCTRINE.** See CALVO.

**DRAGOMAN** (Fr. *dragoman*, *drogman*, OF. *droquemān*, *drogeman*, *drugement*, from Ar. *tarjumān*, interpreter). A name given in the East to interpreters, and hence to the professional guides who accompany travelers and make all arrangements, a service performed in Western Europe by a courier (q.v.). The dragomans attached to the embassies in Constantinople are more or less important official personages.

**DRAGOMANOV**, drā'gō-mā'nōv, MIKHAIL PETROVITCH (1841-95). A Russian scholar and author. He was born at Hadyatch, in the Government of Poltava. In 1865 he was appointed lecturer at the University of Kiev, where he had himself been educated and where he held the chair of general history until 1876. He criticized the educational system of Count Dmitri Tolstoy, which was based on German models of classicism, and refused to send in his resignation because of his Ukrainophil activity; but a special commission, appointed by Alexander II, found him guilty, and he was forbidden to reside in Little Russia and the capitals or to engage in literary pursuits. The Southern Section of the Geographical Society in Kiev was abolished, and the printing of books in the Little Russian

dialect was prohibited. Dragomirov went to Geneva, where he remained until made professor of history at the University of Sofia, in Bulgaria, in 1888. For over 20 years he fearlessly combated autocracy and oppression in all its forms. A strong nationalist, he advocated a complete reorganization of Russia on federative lines, with every nationality possessing equal and equitable representation. As he started out on the field of literary and political activity at a time when the terroristic doctrines were at their height, he stood for political execution, justified it on the ground of necessity and for the ultimate triumph of political liberty. His numerous works in the literary and historical field deal mostly with his native Little Russia, of which he was passionately fond. Beginning with *The Historical Songs of Little Russia*, published by him in collaboration with Professor Antonovitch, in 1874, Dragomirov incessantly worked on the history, folklore, and religious history of his country. After *The Question of Little Russian Literature* (1876), he published a series of popular pamphlets in the Little Russian dialect and, during 1878-82, five volumes of the periodical *Hromada* (*The Commune*). His *Le tyranicide en Russie* appeared in Geneva (1876); *La Pologne historique et la démocratie moscovite* (1881); *The Political Songs in the Ukrainian Language in the Eighteenth and Nineteenth Centuries* (London, 1883-85).

**DRAGOMIROV**, dră'gô-mă'rôv, MIKHAIL IVANOVITCH (1830-1905). A Russian general. He studied at the War Academy in St. Petersburg, where, following further study abroad, he became professor of tactics in 1858. His lectures brought him considerable renown. In 1868, after participating in the Austro-Prussian War as military attaché, he was appointed major general and chief of the general staff at Kiev. As commander of the Russian advance guard in the Russo-Turkish War of 1877-78, he distinguished himself at the crossing of the Danube at Sistova. In consequence of wounds received in the fighting at the Shipka Pass he was compelled to retire from active service and was subsequently appointed director of the War Academy, where he exercised a most salutary influence upon military training. He was Governor-General of Kiev from 1898 to 1903, when he entered the Council of the Empire. His works include: *Lectures on Tactics* (1864); *The Austro-Prussian War* (1866); *Discipline and Subordination* (1894); *A Study of the Novel "War and Peace"* (1895); *The French Soldier* (1897); *War is an Inevitable Evil* (1897); *Joan of Arc* (1898); *Duels* (1900).

**DRAGON** (OF. *dragon*, Lat. *draco*, Gk. δράκων, *drakōn*, dragon, from δέσκειν, *derkesthai*, Skt. *dars*, to see). In the mythical history and legendary poetry of almost every nation the dragon appears as the emblem of the destructive and anarchic principle, as it manifests itself in the earlier stages of society, viz., as misdirected physical power and untamable animal passion striving against human progress. The earliest conception is embodied in the Babylonian myth of Tiamat—the great she dragon—who healed the Titanic hordes of Chaos, and whose destruction by the demiurge Merodach was the necessary prerequisite to an undisturbed and orderly universe. The destruction of the lower representatives of this disorderly element was one of the first objects of human energy, but,

being unattainable by merely human means, the task was assumed by that intermediate class of beings known as heroes in classical antiquity. As the highest ideal of human strength and courage, the task properly fell to Hercules (e.g., Dragon of the Garden of the Hesperides), but it was not confined to him, for we find both Apollo and Perseus represented as dragon slayers. From legendary poetry the dragon passed into art, some of the earliest efforts of which probably consisted in depicting it on the shield or carving it for the crest of a conqueror's helmet. It was used in this way as a sort of Medusa, an *apotropaion* or terror-striking image. Thus it was represented on the war standards of Germanic and Dacian tribes. The dragon does not seem to have been a native emblem with the Romans, and when they ultimately adopted it as a sort of subordinate symbol, the eagle still holding the first place, it seems to have been in consequence of their intercourse with other nations. Among all the new races which overran Europe at the termination of the classical period the dragon seems to have occupied nearly the same place that it held in the earlier stages of Oriental and Greek life. In the *Nibelungenlied* we find Siegfried killing a dragon at Worms; and the contest of Beowulf (q.v.), first with the monster Grendel and then with the dragon, forms the principal incident in the curious epic which bears the name of the former. Even Thor himself was a slayer of dragons. Among the Teutonic tribes which settled in England it was from the first depicted on their shields and banners, as it was also in Germany. Nor was the dragon peculiar to the Teutonic races. Among the Celts it was the emblem of sovereignty and as such borne as the sovereign's crest. Tennyson's *Idylls* have made every one familiar with "the dragon of the great pendragonship," blazing on Arthur's helmet, as he rode forth to his last battle and "making all the night a stream of fire."

Christianity inherited the Oriental idea of the dragon, which is made the emblem and embodiment of the devil. In St. John's Apocalypse—in fact, in all apocalyptic literature—it plays an important part. That Christ should "tread on the lion and the dragon" was an idea handed down from the Old Testament. In later Christian traditions St. Michael is the chief opponent of the infernal, and St. George of the terrestrial, dragon. The dragon in a cave on Mount Soracte represented paganism, and his defeat by Pope Sylvester symbolized the triumph of Christianity under Constantine. In Christian art the dragon is the emblem of sin, the usual form given to it being that of a winged crocodile. It is often represented as crushed under the feet of saints and martyrs. Sometimes its prostrate attitude signifies the triumph of Christianity over paganism, as in pictures of St. George and St. Sylvester; or over heresy and schism, as when it was adopted as the emblem of the knights of the Order of the Dragon in Hungary, an order instituted for the purpose of contending against the Hussites of Bohemia.

The dragon is often employed in heraldry; and other animals, such as the lion, are sometimes represented with the hinder parts resembling dragons. Consult Mähly, *Die Schlange in der Kunst* (Basel, 1867). See GRIFFIN.

**DRAGON.** The name now applied to various lizards. One is a South American tree lizard (*Thorictis drachena*), both eggs and flesh of

which are eaten. Others are members of the iguanid genus *Callisaurus*, several species of which are common in southern California and southward. The name most commonly belongs, however, to the arboreal flying lizards of the genus *Draco* of the East Indies. They are distinguished from all the other living lizards by having horizontally spread-out folds of skin, supported by five or six false ribs, which do not encircle the body, but stand out at right angles from it, forming a parachute, which buoys up the lizard in its extremely swift bounds from limb to limb in pursuit of insects, for it does not possess the power of true flight. It can scale long distances, resembling the flying squirrels in its method of aerial progression. When at rest, the ribs and skin are folded back along the sides of the body and do not interfere with active running about. About 20 species are recognized, none more than 8 inches long, but they keep in the tops of the forest trees, and little is known about them. The most familiar is the Malayan one (*Draco volans*), which is of a brilliant but variable metallic hue above, varied by bands and spots, while the parachute and the throat appendage of the male are orange. Similarly brilliant colors belong to the other species, yet little is seen of them, except when the creature is excited and displays itself in anger or courtship. The dragon has no power of changing its colors, is perfectly harmless, and is frequently kept as a tamed pet. See **PLATE OF LIZARDS**.

**DRAGONADES.** See **DRAGONNADES**.

**DRAGON BIRD.** 1. A name given to the umbrella bird (q.v.), in allusion to the shape of its crest, which resembles the ornamental top of the helmet of a dragon of the eighteenth century. 2. An Australian ant thrush (*Pitta strepitans*).

**DRAGONET** (OF. *dragonet*, diminutive of *dragon*, dragon). A fish of a genus (*Callionymus*) usually classed with the gobies, but by some authors given separate family rank. They are remarkable for having the gill openings reduced to a small hole on each side of the nape, and the ventral fins placed under the throat, separate, and larger than the pectorals. They have no air bladder. The species are pretty numerous, mainly inhabitants of the temperate coasts of the Old World, but some living in Oriental tropical seas, and of brilliant and quaint appearance. The sexes differ greatly, the adult males having the fin rays produced into filaments, and the intervening membranes highly colored, especially in the breeding season, whereas the females wear a more sombre dress. Hence the beautiful British species, the gemmeous dragonet, or yellow sculpin (*Callionymus lyra*), was formerly considered two species, one of which was finally discovered to be the female of the other. They feed upon small shellfish.

**DRAGONETTI**, drù'gò-nèt'té. DOMENICO (1763-1846). A noted Italian double-bass player, born in Venice. He studied double-bass playing under Berini, a member of the band at San Marco, was admitted to the orchestra of the Opera Bouffe in 1768 and in 1769 to that of the Opera Seria. In 1773 he succeeded Berini at San Marco. He went to London in 1794, at once gained fame, and thenceforth resided chiefly in England. He was in 1808-09 in Vienna, where he had also visited his friend Haydn in 1798. His title of "patriarca del contrabasso" was not merely honorary; for in 1845, at the age of 82,

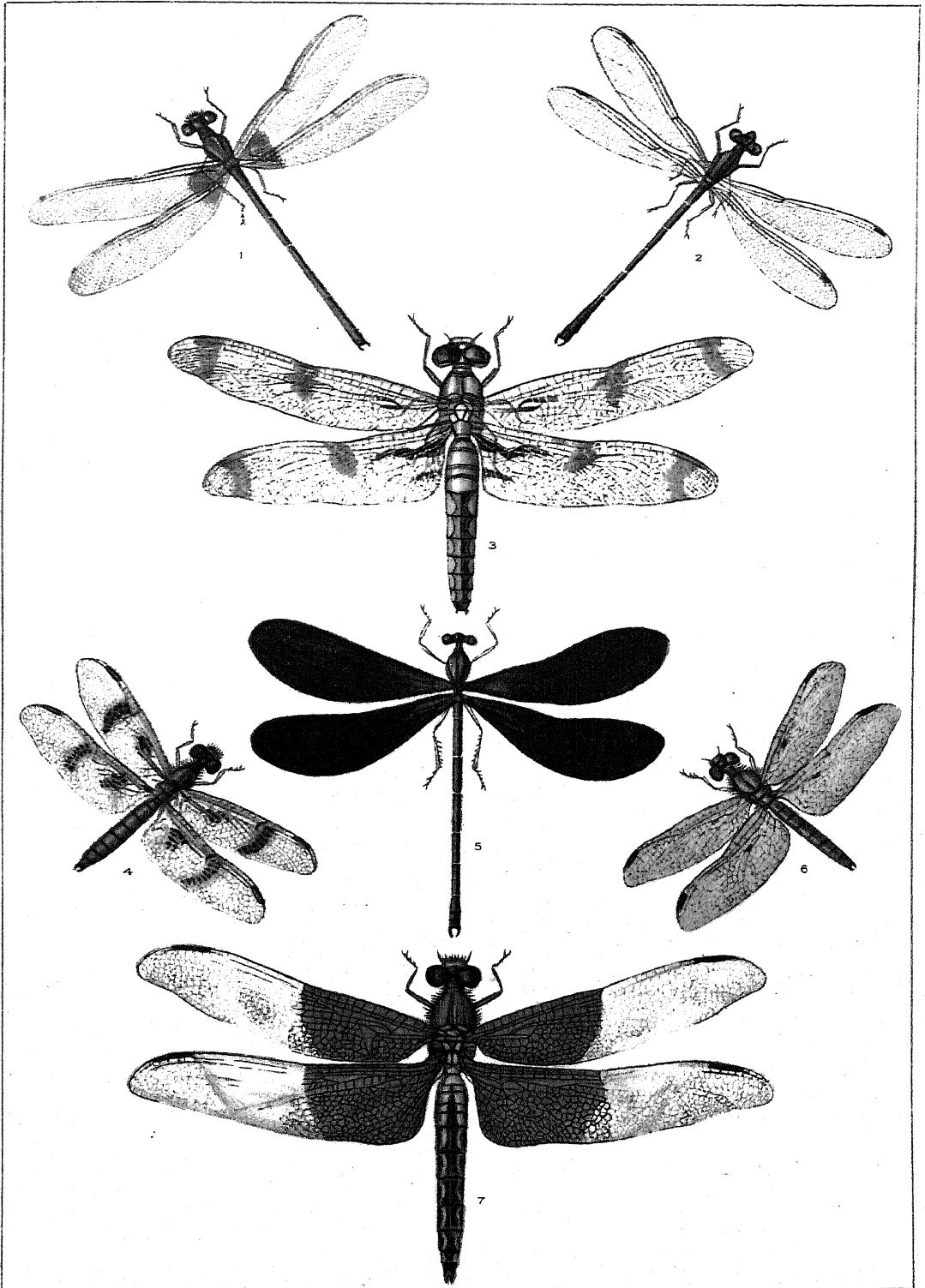
he headed the 13 double basses at the Beethoven festival in Bonn and won high commendation from Berlioz. As a performer, he has probably never been excelled. His instrument, a Da Salò, bought at the San Pietro Monastery, Vicenza, he presented to the vestry of San Marco, and to the British Museum he gave 182 bound volumes of the scores of classical operas. He published little.

**DRAGON FISH.** One of several small gurnard-like fishes of the genus *Pegasus*, inhabiting Oriental and Australian seas. Its body is covered with bony plates, which are movable except near the tail; and the pectoral fins are large and fanlike. The eyes are very prominent, and the snout greatly prolonged and toothless. A common Indian species is *Pegasus draco*, and another species (*Pegasus volans*) is frequently seen dried as a curiosity or serving as an ornament on boxes, etc., made in China. Little is known of their habits.

**DRAGON FLY.** Any amphibious insect of the order Odonata. These insects possess numerous popular names, such as snake feeder, horse stinger, spindle, devil's darning needle, and mosquito hawk. They have very large heads, due to the excessive size of the eyes; the antennæ are short, and the biting mouth parts are powerful; the four wings are of similar size and structure; the legs are long and used for perching rather than for crawling. Two distinct types of dragon flies are now recognized: (1) Zygoptera, whose wings in repose are held upright; and (2) Anisoptera, whose wings are held horizontal. To the former group belong our common slender-bodied blue forms sometimes called damsel flies, while to the latter belong our larger and usually more sombre species. Both kinds are most frequently found about ponds, marshes, or streams, but some forms go a considerable distance from water, in meadows, in sunny hours, where they hawk for small insects with exceeding speed and voracity. The Zygoptera fly nearer the ground and more among vegetation than do the Anisoptera. Dragon flies are known to swarm, both in America and in Europe, but the causes of these migrations are unknown. Although harmless, these insects are much feared by persons unacquainted with them, which explains some of the strange names and accounts for the quaint beliefs that exist among the country people, who say that if a "darning needle" gets into your hair most disagreeable things will happen, the least of which is the sewing up of the ears. The folklore of Europe, the Orient, and Japan abounds in superstitions and sayings in regard to these quite innocent but fierce-looking insects.

*The reproductive habits of dragon flies* are unique in that there is no direct transference of the sperm from the genital ducts to the female, as in other insects. The sperm, previous to the transference, is stored in an accessory receptacle near the base of the male abdomen. The clasping attitudes are also peculiar. The male grasps the neck of the female by means of a pair of forceps at the end of the abdomen, the female then bends forward the apex of her abdomen to the accessory sperm receptacle near the base of the male's abdomen, and thus the actual transference of the sperm takes place. Among the Zygoptera the pairs often fly about tandem-like, the male-clasping the neck of the female; and in some species the male may even retain his hold and accompany her when the female crawls be-

# DRAGON-FLIES



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- |  |   |
|--|---|
| 1 RED-SPOTTED DAMSEL-FLY - <i>HETÆRINA AMERICANA</i> | 4 THE AMBER-WING (FEMALE) - <i>PERITHEMIS DOMITIA</i> |
| 2 GREEN-BODIED DAMSEL-FLY - <i>LESTES EURINA</i>     | 5 THE BLACK WING - <i>CALLOPTERYX MACULATA</i>        |
| 3 BANDO O DRAGON-FLY - <i>LIBELLULA SEMIFASCIATA</i> | 6 THE AMBER-WING (MALE) - <i>PERITHEMIS DOMITIA</i>   |
| 7 THE BASAL DRAGON-FLY - <i>LIBELLULA BASALIS</i>    |   |

ALL NATURAL SIZE



neath the surface to oviposit. The females which go beneath the surface are those which oviposit in the tissues of plants. In some dragon flies the eggs are dropped or washed off of the abdomen by dipping it into the water or striking it upon the surface. Larvæ of Odonata are called "nymphs" and are aquatic and carnivorous. The lower lip is greatly developed and forms a powerful grasping organ. The zygopteran nymphs have three platelike gills at the end of the abdomen, while in the anisopteran nymphs respiration takes place in the greatly modified posterior part of the intestine, into which water is drawn, and may be expelled with force sufficient to aid in locomotion. In the zygopteran genera *Euphæa* and *Anisopleura* the nymphs also possess, in addition to the terminal gills, lateral abdominal gills. Certain kinds of nymphs show decided preferences for certain habitats—some choosing standing water, others small streams, and still others rapid water. These preferences are as marked as in the case of the particular places frequented by the adults.

When a nymph is fully grown, it crawls out of water and attaches itself, by means of its claws, to some support. The nymph skin then splits along the top of the head and down the back, and through this rupture the imago escapes. At first the body and wings are limp and contracted, and only gradually expand to their full size; but the adult colors do not appear for several hours, or even days, after emergence. The duration of the life of the imago varies from about three to six weeks for many forms, but in the case of those few forms which hibernate the limit may even extend over six months.

While the dragon fly, on account of its preying upon small insects and mosquitoes, is considered beneficial, the nymphs, on the other hand, have been credited with destroying young fish in hatcheries. While small insects doubtless form the bulk of their food, the larger species do not hesitate to attack even wasps and butterflies.

The greatest extremes in size are found among the slender-bodied Zygoptera. The smallest is a Javanese species (*Agrioenemis minima*), whose abdomen is about  $\frac{1}{2}$  inch long, and the largest is *Megaloprepus caerulatus*, from Central America, whose abdomen is about 4 inches long. A very large anisopteran (*Gynacantha plagiata*), from Borneo and Sumatra, has an abdomen nearly equal to the latter in length.

The damsel flies are slender-bodied, delicate-winged forms, usually showing spots of brilliant color. The red-spotted (*Petersonia americana*), the black-wing (*Calopteryx maculata*), and the green-bodied (*Lestes eurina*) are among the most common in the eastern United States.

The amber-wing dragon fly (*Perithemis domitia*) shows very decided sexual differences—the female having clear wings with two pairs of irregular amber bands, while the wings of the male are wholly amber yellow. Among our most abundant large dragon flies are the banded (*Libellula semifasciata*) and the basal (*Libellula basalis*), both common about our ponds and streams throughout the summer months. All of these forms are figured on the Colored Plate.

About 2000 species of Odonata are known, the most of which are from tropical countries; but about 300 species occur in North America. Consult Miall, *Natural History of Aquatic Insects* (London, 1903), and Felt and Needham, "Aqua-

tic Insects of New York State," *Bulletin* 68, *New York State Museum* (Albany, 1903).

*Fossil dragon flies*, of which at least 75 species have been described, appear first in the Lias, where they present already a considerable differentiation, the majority of subfamilies being represented in the rocks of that period. In the Jurassic limestones of Solenhofen, Bavaria, occur numerous examples, mostly of extinct genera, that are often preserved in the finest manner, with the wings spread out. Dragon flies are also found in all the Tertiary insect-bearing beds, and the larvæ and pupæ occur in great abundance at Oeningen, Germany. See NEUROPTERA. See DAMSEL FLY and Plate of DRAGON FLIES.

**DRAGON LEECH.** See LEECH.

**DRAGONNADES**, or **DRAGONADES** (Fr., from *dragon*, dragoon, so called either from their firearm, which was ornamented with the head of a dragon, or from their standard, which bore a dragon). The name applied to a series of religious persecutions in France, which was inaugurated shortly before the revocation of the Edict of Nantes (1685) and continued for some time. Louis XIV's Minister of War, the Duc de Louvois, was responsible for the cruel measures taken to compel the Protestants to renounce their faith and enter the Roman church. Armed expeditions marched through the provinces demanding of the Huguenots (q.v.) in the small towns and villages that they should abjure their faith. Foremost among the armed force rode dragoons, who, on account of their barbarity, had the unenviable honor of giving a name to the persecutions. It was the custom to quarter the dragoons in the houses of those Huguenots who showed themselves particularly obstinate in denying the doctrines of Catholicism. The outrages committed by a brutal soldiery, free from all restraint and, in fact, encouraged in their licentious conduct, made life not only impossible for the Huguenots and drove thousands of families out of the country or into the bosom of the church. Louis was delighted to find that from 250 to 400 Protestants were being converted daily, and in consequence, on Oct. 22, 1685, a few months after the date of the first of the persecutions, he revoked the Edict of Nantes (q.v.), that the good work might be fully accomplished. Under Louis XV the dragonnades were renewed by the chief minister, the Duc de Bourbon. Consult: Rousset, *Histoire de Louvois* (4 vols., Paris, 1863); Tylor, *The Huguenots in the Seventeenth Century* (London, 1892); Perkins, *France under the Regency* (Boston, 1892); Baird, *The Huguenots and the Revocation of the Edict of Nantes* (New York, 1895).

**DRAGON OF WANTLEY, THE.** A ballad, apparently a parody on the old romances, which appears in Percy's *Reliques*. The dragon, who lives in a well, is killed by the hero, More of More Hall, clad in a suit of spiked armor.

**DRAGON'S BLOOD** (so called on account of the color), or GUM DRAGON. An astringent resinous substance obtained from several trees of different natural orders, growing in warm countries. The greater part of the dragon's blood of commerce is produced by the *Calamus draco*, growing in the East Indies, the resin being attached in the form of hard, brittle masses to the fruits of the tree. Two varieties of dragon's blood occur in commerce. One variety is brought in the form of sticks, the other in the form of cakes. The separation of the resin from

the fruits is effected either by shaking the latter in large bags or by boiling them in water.

American dragon's blood is derived from the *Pterocarpus draco*, and similar resins are produced by the *Dracena draco*, the *Croton draco*, and the *Eucalyptus resinifera*. True dragon's blood is a colorless and tasteless substance melting above 80° C.; American dragon's blood is opaque, of a deep reddish brown color, brittle, smooth, with a shining shell-like fracture, and when burned emits an odor resembling that of benzoin. It is nearly insoluble in water, but is soluble in alcohol, benzene, carbon disulphide, and many oils. It was formerly used in medicine; at present, however, it is employed in the preparation of varnishes and lacquers and in photo-engraving processes.

**DRAGON'S MOUTH** (Sp. *Boca del Drago*). A short strait on the coast of Venezuela, South America, which connects the Gulf of Paria with the Atlantic and separates the north end of the island of Trinidad, on the east, from the Paria peninsula on the west (Map: West Indies, G 5).

**DRAGON TREE**. See *DRACENA DRACO*.

**DRAGOON**. A soldier trained to fight either on foot or on horseback. The name has been derived, by different authorities, either from the dragon emblazoned on the standard carried by such troops, or from the dragon's head on the muzzle of the short musket formerly carried by dragoons. Since the time of Frederick the Great the name has been used, generally, to designate a class of cavalry between heavy and light cavalry. Formerly some of the mounted regiments of the United States army were known as dragoons. The term is no longer used. In England the Scots Greys (organized 1683) is the oldest dragoon regiment. See *CAVALRY*; *MOUNTED INFANTRY*.

**DRAGOMIS, STEPHAN** (1842- ). A Greek statesman, born in Athens. He studied in Athens and Paris and in 1879 was elected to the Lower House of the Greek Parliament. In 1886-90 and in 1892 he was Foreign Minister. He formed a cabinet in February, 1910, which survived until October, succeeded in calming the Military League and in convoking a National Assembly, and opposed the movement to side openly with the Thessalians against Turkey. In 1912 he was sent to take over the government of Crete.

**DRAGUIGNAN**, *dra-guignān*. The capital town of the Department of Var, France, on the Nartuby, a tributary of the Var, 40 miles northeast of Toulon (Map: France, L 5). It is situated in a valley surrounded by hills, the slopes of which are covered with vineyards and olive plantations. Its principal buildings are the prefecture, the courthouse, a hospital, and a museum containing pictures by Rembrandt, Teniers, and Panini, a zoölogical garden, and a public library of 25,000 volumes. It has manufactures of coarse woollens, leather, hosiery, silks, soap, brandy, lumber, oil, and earthenware. Pop., 1901, 9671; 1911, 9974. The town was founded in the fifth century. Claude Gay the botanist was born here in 1800. During the Middle Ages it was strongly fortified. The fortifications were destroyed in the civil wars, but were reconstructed in 1615. It replaced Toulon as the capital of the department in 1793.

**DRAINAGE**. In law, a right to discharge surface water from one's land upon the land of another. The civil law of Rome recognized a natural right of drainage as between adjacent lands of different elevations, the rights of the owners of such lands being governed by the

law of nature. By that law, which has been adopted in Pennsylvania, Illinois, California, and Louisiana, the lower proprietor is bound to receive the surface waters which naturally flow from the estate above, provided the servitude has not been increased by the acts of the upper proprietor.

No such right exists by the common law, and it is held in most of the United States, as well as in England, that the lower proprietor may lawfully obstruct the flow of surface water upon his land from that of his neighbor, though the latter is not liable for any damage which may result from the natural flow of such water upon the lands of the former. In both systems of law, however, a riparian proprietor may drain his land into a natural watercourse which flows over or by his land, and no obstruction of the stream by the lower proprietor which prevents such drainage will be permitted. This is a natural, as distinguished from an acquired, right of the riparian proprietor, and is therefore strictly analogous to the natural servitude of drainage of the civil law above alluded to. It exists *ex jure nature* and is incapable of alienation, of release, or of severance from the land.

Apart from this limited natural right of drainage, the common law recognizes also an easement of drainage, which may be acquired by grant or prescription over the land of another. This may exist with or without an artificial construction and may be superficial or subterranean. The common-law right of cave-dropping is one form of this easement, though its usual form is the right to construct and maintain an artificial drain and to discharge water through the same into and through the adjoining premises. The familiar right of the householder in a city or village to discharge water into a public or municipal drain is of this nature. The right is violated by any interference or obstruction caused by the owner of the lower or "servient" estate, whether intentional or not, and may be enforced by an action for damages or by injunction to prevent a threatened or continued interference. The easement carries with it the right to enter on the premises affected by it in order to repair the drain and keep it open; but it is, like other easements, carefully restricted to the amount and kind of user included in the terms of the grant. See *EASEMENT*; *SERVITUDE*; *WATERCOURSE*; and the authorities there referred to.

**DRAINAGE** (from *drain*, AS. *drehnian*, *dreahnian*, *drēnian*, Icel. *dragna*, from AS. Goth. *dragan*, Icel. *draga*, OHG. *tragen*, Ger. *tragen*, Eng. *draw*, *drag*). The removal of surplus water from the soil by means of canals, open ditches, and drains, or other conduits which are either porous or else laid with open joints. In its larger sense the term "drainage" applies to the reclamation of extensive areas of land either under water or in the condition of marsh or swamp, and consequently unfit for habitation or cultivation. In agriculture drainage implies the removal of surface or subsoil water from a more limited area which it is desired to put under specific cultivation, and generally is understood to involve the use of tile drains, as will be described below. The name "drainage" is also used to denote a system of sewerage for the removal of liquid household wastes as well as the surface and subsoil water of towns and cities. This aspect of the subject will be found treated fully under the head of *SEWERAGE AND DRAINAGE*.

**Reclamation of Land**. In reclaiming large



tracts of land, often of great fertility, but which are at so slight an elevation above the sea or the neighboring streams that they can be rendered fit for cultivation and habitation by artificial means only, dikes or embankments are constructed to keep out the flood waters, and a system of canals built to collect and carry off the superfluous water. In the case of marsh lands the method employed depends upon the elevation and conformation of the land to be drained, but all lands may be divided into two classes—those that can be drained by gravity, and those in which the water must be pumped out, either all or a part of the time. Many coast lands are so low that the water will run off only at low tide, and such lands are protected from high tide by embankments. The water is gathered by a network of subsidiary ditches into a few main drains, which carry their contents into the sea at low tide. The tidal flow is kept out by automatic doors or sluices. The problem of draining low lands by gravity is an increasingly difficult one, because a section that is drained tends to sink, through shrinkage, below its former level. Hence it happens that land which at first was drained by gravity afterward, through subsidence, requires pumping to carry off the water. Much of the land that has been most successfully reclaimed from encroaching waters has been so low that it required pumping to carry the drainage off during a whole or a part of the year. This is particularly true in Holland. Many other considerations, besides the actual level of the land to be drained, must be taken into account in devising a system of drainage for low lands. The object sought in laying out drains in a flat country is to provide channels of the least possible area, depth, and inclination that will suffice to carry off the water properly. Every increase beyond this point is a waste of land and of expense in excavation; and where pumping is necessary, the greater the inclination or grade of the canal, the higher will be the lift. Usually a much greater area must be devoted to ditches when the land is drained by gravity than by pumping, so that the increased expense for constructing and maintaining ditches will sometimes equal the cost of installing and operating pumps.

In determining the number and capacity of drains required, the local rainfall and the absorbent power of the soil must be taken into account. Low areas, surrounded by higher land, often have not only the rainfall on their own area, but also the drainage from the surrounding country to be provided for. This is prevented, whenever practicable, by separating the low land from the surrounding country by a catch drain (q.v.). Care should be taken that the subsidiary ditches or drain pipes do not discharge into the main canal at a point below the water level of the latter, for, if this happens, the free circulation of air through the soil by means of the drains is impeded, and there is danger that the water will back up. Drainage canals should be kept free from weeds, for their growth impedes the flow of water by decreasing the area of the ditch and by increasing the friction of the running water. Various machines have been devised for cutting the growth of weeds in ditches and for digging them out by the roots. Having considered some of the most general principles underlying the construction of a drainage system, a few of the most important examples of land reclamation will be described.

One of the best-known and most extensive systems of land reclamation is found in Holland. Here the greater part of the country is low and flat and is protected from inundation by an enormous system of dikes. The soil was originally marshy, and the territory included numerous lakes. By an elaborate and scientific system of canals many of these marshes and lakes, now called *polder-land*, have been drained and converted into fertile soil. (See *POLDER*.) The most famous of these polders is the former site of the Haarlem Lake, where a population of nearly 20,000 people are now dwelling. Another of these polders is the Biesbosch.

The Haarlem Meer was formed in the sixteenth and seventeenth centuries by the junction of several small lakes. Three villages were covered with water, the last in 1647, and much otherwise valuable territory was rendered useless. Of the various early plans for relief, one proposed by Leeghwater in 1643 contemplated an embankment around the whole area, and 160 windmill-driven pumps, with an estimated cost of about \$1,500,000. In 1836 the Meer was extended still further, and in 1837 work was begun for the reclamation of 44,724 acres of land, covered with some 13 feet of water. An embankment  $37\frac{1}{2}$  miles long was built around the lake, and a canal then in existence was improved and extended, partly for navigation. It was decided to use steam power for pumping; three engines were erected for that purpose.

The first engine lowered the lake 6 inches in about 10 months, after which it took the three engines 39 months to complete the work. Ditches within the lake bed were then built, the main ditches leading to the pumps. A total of 750 miles of ditches were dug. The cost of the project was about \$5,500,000.

The Zuyder Zee forms an arm of the North Sea, and was created in the year 1170 by a severe storm breaking down the sand dunes along the coast and inundating the land for a distance of 60 miles.

Previous to the year 1892 a commission was appointed to investigate a project for draining the Zuyder Zee. Favorable reports were presented by the commission in 1894 and 1897, and in 1900 a bill providing for the work was introduced in the States-General, but it was withdrawn in 1901. Apparently it was decided to concentrate efforts, for a time at least, to one of the areas named below.

It was proposed to inclose the inner part of the Zuyder Zee by an embankment, 18 miles long and as many feet high, from Wierengen to Piaam, with four other inclosing banks to inclose as many areas which were to be pumped dry. This would leave an inland sea of 560 square miles surrounding these areas and cut off from the North Sea by the above-mentioned dike, whose elevation would be lower than that of the exterior water. The Yessel River would empty into this, and the inland lake in turn would empty by sluices through the dike into the North Sea. The estimated cost of the completed plans was about \$79,000,000, and it was expected to take 33 years to complete. The area thus reclaimed would be about 480,000 acres, with a net renting value of \$10 an acre, giving a revenue of \$316,000 a year after paying interest and principal.

The Fens is a large tract of flat and marshy land on the east coast of England. The whole region was, centuries ago, converted into an un-

profitable marsh by repeated incursions of the sea, coupled with obstructions to the outward flow of the rivers Nene, Cam, Ouse, Welland, etc. Vast operations have been carried on ever since the time of Charles I by digging new channels and outfalls and employing windmills and steam engines to pump the water from the marshes and ponds into these artificial channels. Early in 1914 it was reported that the Fens drainage works served two districts of 30,000 and 2000 acres respectively, administered by two "trusts." For the larger trust two centrifugal pumps, each driven by a 50-horsepower Diesel oil engine, were to be installed to supplement the old scoop water wheels, 20 feet in diameter, which lift water 4 feet to the canal. These wheels were first driven by beam engines of 60 and 80 horsepower each, built in 1825 and rebuilt in 1883. The smaller trust had already replaced its beam engine by a 50-horsepower Tange gas engine and suction gas-producer plant, belted to the old 18-foot water wheel, which lifts water 3 feet. These pumping plants are operated in wet seasons only.

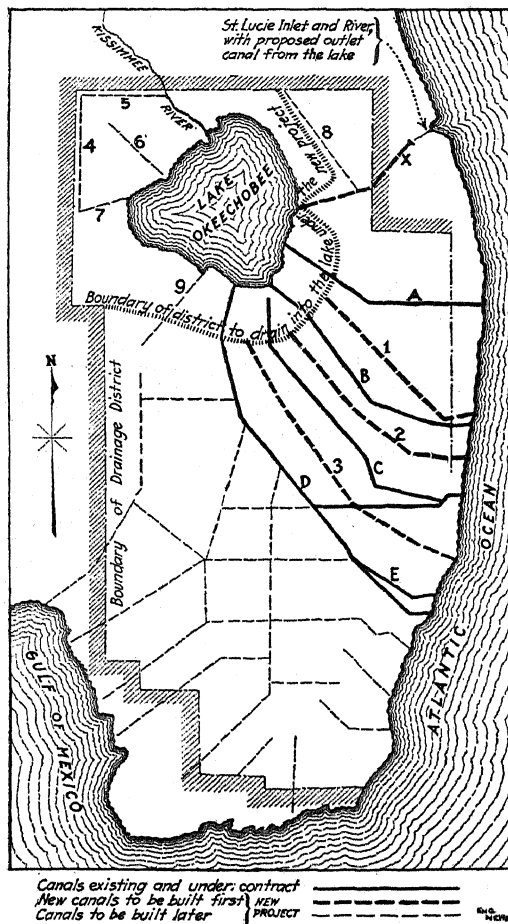
In the valley of the Po, by the end of the nineteenth century some 600,000 acres of marsh land had been drained and transformed into rich farmland, the water being lifted off by pumps. To extend this work the Italian government appropriated \$40,000,000, to be spent from 1900 to 1933, under an act requiring local governments and individual property owners to spend two-thirds that amount for the same general purpose. The same kind of work has been done in the south of France. In the delta of Lower Egypt work was begun in 1912 by the government to reclaim 973,500 acres of land at an estimated cost of \$12,500,000. Four years was allowed for the work.

In America a large amount of land has been reclaimed by gravity canals and ditches in the Central West, the South, and Southwest, particularly in Illinois, Indiana, Minnesota, Florida, Louisiana, Arkansas, and Missouri.

The Florida Everglades present a great and interesting opportunity for drainage, and considerable has been accomplished there by both the State and private companies. The Everglades occupy an area of about 4000 square miles in southern Florida, beyond Lake Okeechobee. They are in effect an immense marsh, the lands of which, on being drained, are very fertile. An important engineering report on the drainage of the Everglades was made in 1912 by Daniel W. Mead, of Chicago, Allen Hazen, of New York, and Leonard Metcalf, of Boston, in behalf of private land interests. They concluded that the system of canals built and proposed by the State of Florida "is entirely inadequate for the drainage of the Everglades" and that these canals would actually contribute to the flooding of the land by affording a ready passage thereto of the waters of Lake Okeechobee when the lake level is high. The first problem, they declared, was the control of the lake so as to prevent flooding the Everglades and so as to store its waters for purposes of irrigation at other than flood seasons. The next problem was the drainage of the Everglades. Each problem could best be solved by building canals. Careful study of the problem was advised.

A second engineering report on draining the Everglades was made public early in 1914. This report was by Isham Randolph, of Chicago, Marshall O. Leighton, of Washington, and Edmund T. Perkins, of Chicago, and was made to

the commissioners of the Everglades Drainage District and the trustees of the Internal Improvement Fund of the State of Florida. The commission advised lowering the level of Lake Okeechobee and taking care of waters coming to the lake from the north by providing a canal 24 miles long from the lake to the St. Lucie River and Atlantic Ocean. Besides lowering the lake, this canal would form a navigable waterway and would also make possible the development of 5000 horsepower, which would be particularly valuable in a section without mineral fuel. The estimated cost of a canal 24 miles long, 200 feet wide on the bottom, with a 12-foot water depth, was \$2,259,000, includ-



ing locks and dam. The lake-control canal would lessen the burden resting on the land-drainage canals, but it would still be necessary to build three canals to the Atlantic Ocean at an early date (in addition to the four already built or under construction or contract by the State). Later on, additional canals would be advisable, some leading to the Atlantic Ocean and some to the Gulf of Mexico. Nine short canals were also recommended for draining the area bordering on Lake Okeechobee, these to discharge into the lake itself. The estimated cost of the three new land-drainage canals to be built at once and of enlarging the canals already built or under way was \$4,281,000. This would provide 391 miles of canals and drain

2095 square miles, as compared with the 255 miles of canals draining 1084 acres of land now built or being built. The canals advised for future construction, as land sales and utilization demand, aggregate 428 miles in length, would drain 3504 acres, and were estimated to cost \$15,866,000. The grand total of all the work recommended involves an estimated expenditure of \$22,406,000, for the ultimate drainage of 5599 square miles of land, besides navigation and water-power improvements. It should be added that the canals already built or under construction also make provision for navigation. For abstracts of the lengthy reports here briefly outlined, consult the *Engineering News*, Oct. 23, 1913, and Jan. 15, 1914, from which latter issue the accompanying map is reproduced.

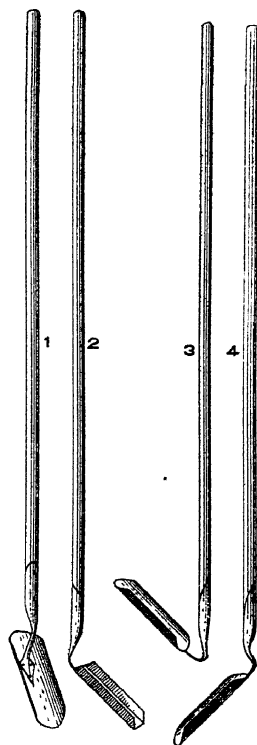
Mosquito-reduction campaigns have led to the drainage of many large and small areas of land in various parts of the world since the establishment of the relationship of these insects to malaria and yellow fever at the close of the nineteenth century, and since it was learned that the mosquito pest in general could be reduced in the same way. Besides the work of this kind along the Panama Canal, probably the most notable example is afforded by the work done by the State of New Jersey, beginning in 1904. Thousands of acres of meadow land have been drained by hundreds of thousands of feet of ditch since the work was begun. The work has been carried out under the direction of the State entomologist. Novel and efficient ditching machines have been employed.

Drainage, strangely enough, often has to be followed by extensive drainage works, to prevent the land from becoming marshy or from being ruined by water.

**Drainage of Farm Lands.** The works already described are for the main drainage of large areas. They leave for the individual farmer the task of removing surface water from

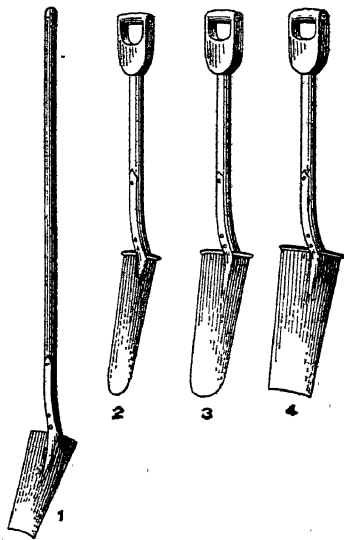
freeing land from superfluous water was by open ditches and drains, but throwing up the land in beds, hilling, and ridging were practiced with the same object in view. These, however, are only partial and superficial in their effects. The Roman agricultural writers mention the good results arising from covered drains, which were formed of stone, wood, or other substances. Cato, who wrote in the second century B.C., gave specific directions for drainage. The art of drainage was understood and practiced at a much earlier date by the Egyptians and Babylonians. Primitive methods were also practiced to a limited extent in early days in Great Britain and on the continent of Europe. The progress of draining, however, was slow and partial until well on in the nineteenth century, when the practice was reduced to a system.

The use of drain tile in France is said to have begun many centuries ago, but to have become a lost art. Drain tiles were first used in England in 1840, according to Elliott. Their use spread rapidly in England and Scotland after 1840 and soon came to France and Germany. In the United States John Johnston introduced handmade tile on his farm at Geneva, N. Y., in 1835, and, "by 1851 he had laid 15 miles of drains with most gratifying results" (Elliott). The first drain-tile machine was imported from England to the United States in 1848. The most efficient system of drains can be laid out only after careful leveling (q.v.) of the land to be drained. The smaller drains usually open into larger or main drains, which are laid in the lowest ground, instead of each discharging its quota of water into an open ditch. This is rendered necessary, as the mouths of the smaller drains would be more liable to be choked up by the growth of weeds; while the collecting of water into main drains secures a fuller flow to sweep out any matter which might accumulate where the discharge is small. Moreover, the less the action of the air in the drains, the more efficient they are. The most efficient and at the same time the cheapest ditch is made so that a pipe of cylindrical form may be laid along its bottom, which need be of no greater width than is necessary to allow of the pipes being properly laid. Ditches of this form are cut with a set of spades, which are of different widths—the broader implements being used for taking out the top, and the narrower for the



FINISHING TOOLS.

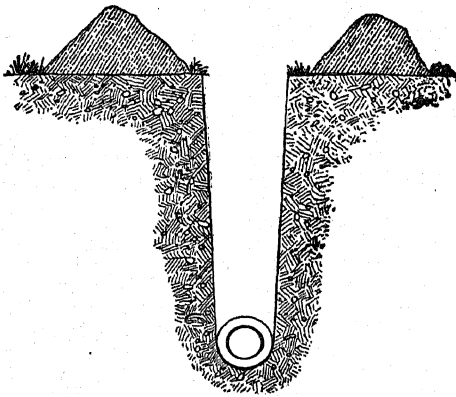
1, groove maker for round tile, operated by pushing; 2 and 4, the same for hexagonal tile; 3, groove maker for round tile, operated by drawing.



No. 1, long-handled shovel for loose earth; 2, 3, 4, spades for digging the ditch.

his own land to the main ditches or of lowering the ground-water level to increase the productivity of the soil. The earliest method of

bottom. The implement which prepares the bottom of the ditch for the tile is called a draining scoop, of which there are a variety of forms. Various forms of machines adapted to digging ditches for drains are found in the market. Before the general use of pipes stones were the common materials with which drains were formed. It was recommended that they should be broken so as to pass through a ring  $2\frac{1}{2}$  inches in diameter. From 9 inches to 1 foot in depth was the quantity which was commonly put in. When tiles and pipes were first used, it was even thought necessary to have some gravel, or small stones, placed above them in the drains, for the purpose of enabling the water to find its way into them. It was soon found, however, that tile drains were quite as efficient without any stones or gravel. Many kinds of tiles and pipes have been tried, but the cylindrical form is most used. At one time a bore of 1-inch diameter in the tile was thought sufficient, but tiles of 3 to 4 inches are now preferred. They are usually made 12 or 15 inches in length. The continuity of the drain is sometimes maintained by collars, but these are expensive and are not considered necessary. In soft or clayey subsoil semicylindrical tiles have been laid with the bend up, but this is rarely, if ever, necessary. The size of the tile required depends on the size of the area to be drained. Concrete tiles have come rapidly into use since about 1900 and when properly made, as they may readily be, give satisfaction.



CROSS SECTION OF DRAIN,  
Showing tile in place.

There is much difference of opinion as to the proper depth and distance apart of drains. Smith, an early worker in this field, at first advocated placing the drains from  $2\frac{1}{2}$  to 3 feet deep, and at intervals of from 10 to 40 feet according to the nature of the land. Experience, however, has been gradually favoring deeper drains, beyond the reach of plant roots and at wider intervals. Even on the most tenacious soils, with subsoils of till, few now think of having drains less than 3 feet in depth, though the distance apart should not in many cases be more than from 25 to 30 feet. The depth, however, depends greatly on the soil— $3\frac{1}{2}$  and 4 feet, with the leader drains 6 inches deeper, are common dimensions. In peaty land the depth has sometimes to be 7 feet. The width between drains depends on the wetness of the land and the character of the subsoil. King states that

"in loose, loamy soils, and especially if underlain by sand, good drainage will be secured with drains 100 feet apart and  $3\frac{1}{2}$  feet deep. On heavier soil they must be closer." The following table, given by Parkes, may be studied with profit in this connection:

MASS OF SOIL DRAINED FOR DIFFERENT DEPTHS  
AND DETAILS OF TILE

Depth of drains	Distance between drains	Mass of soil drained per acre
<i>Feet</i>	<i>Feet</i>	<i>Cubic yards</i>
2	24	3,226 $\frac{1}{2}$
3	33 $\frac{1}{2}$	4,840
4	50	6,453

The principal advantages of drainage of ordinary farm lands are: (1) the removal of stagnant water, the presence of which favors the formation of chemical compounds injurious to crops, keeps the land cold by evaporation, and delays not only plowing, planting, and subsequent tillage operations, but harvesting; (2) the deepening of the surface stratum of friable soil, with the consequent increase of feeding ground for the roots of plants, and the increased capacity of the soil to absorb rains and manures and to retain them and also capillary water during the summer. Drainage is also one of the most efficient means of removing excess of soluble salts from alkali soils (q.v.) and thus rendering them fit for the growth of useful crops. Subsoil drainage has been perhaps the most valuable improvement connected with agriculture. Consult: Wheeler, *The Drainage of Fens and Lowlands by Gravitation and Steam Power* (London, 1888); King, *Irrigation and Drainage* (New York, 1899); Elliott, *Engineering for Land Drainage* (New York, 2d ed., 1912); id., *Practical Farm Drainage* (ib., 2d ed., 1908). See SWAMP; SAVANNAS; BOG; ALKALI SOIL.

**DRAINAGE.** For the use of this term in physiography, see RIVER; VALLEY; GEOLOGY.

**DRAINAGE TUBES.** In surgery, tubes of rubber or glass employed for removing pus or septic matter from tissues or from cavities. The rubber drainage tubes are the ones most frequently used. They are of soft rubber, from  $\frac{1}{8}$  to  $\frac{1}{2}$  an inch in diameter, and from a few inches to 7 or 8 inches in length, or even longer, and are perforated by numerous holes, from  $\frac{1}{8}$  to  $\frac{1}{4}$  of an inch in diameter, throughout their length. The glass tubes are used mainly for abdominal work and are of large diameter, usually from  $\frac{3}{8}$  to  $\frac{5}{8}$  of an inch. For special purposes tubes of metal and hard rubber have been employed. When placed in fresh wounds, or in the body cavities after operation, when suppuration is absent, their object is to remove blood, serum, or discharges which by their subsequent accumulation might become a source of septic infection. Drainage tubes were first introduced by the distinguished French surgeon Chassaignac.

**DRAIN GAUGE.** See LYSIMETER.

**DRAISINE.** An early form of velocipede. See BICYCLE.

**DRAKE, ALEXANDER WILSON** (1843—). An American artist and critic, born at Westfield, N. J. He studied oil and water-color painting and practiced wood engraving. From 1870 to 1881 he was director of the art depart-

ment of *Scribner's Magazine*, and thereafter he held a similar position on the *Century* and *St. Nicholas*. In this capacity he did much to aid the development of the new school of wood engraving in America. He was also identified with other important art movements in the United States.

**DRAKE, CHARLES DANIEL** (1811-92). An American jurist, born in Cincinnati. He served for some years in the United States navy, then studied and practiced law in his native city, and afterward went to St. Louis, where he was a member of the Missouri Constitutional Convention of 1865. From 1867 to 1870 he was a member of the United States Senate and from 1870 to 1885 was Chief Justice of the Court of Claims in Washington. He published a *Treatise on the Law of Suits by Attachment in the United States* (1854) and *Union and Anti-Slavery Speeches* (1864).

**DRAKE, DANIEL** (1785-1852). An American physician. He was born in Plainfield, N. J., graduated in the medical school of the University of Pennsylvania in 1815, and settled in Cincinnati, Ohio, where he became known as a physician and writer. In 1820 he organized the Medical College of Ohio in Cincinnati and secured a State appropriation for its support and that of a hospital. In 1827 he founded the *Western Journal of the Medical and Physical Sciences*, which he continued to edit until 1848. He was connected, either as a lecturer or professor, at different times, with Transylvania University, Lexington, Ky., the University of Louisville, and Jefferson Medical College, Philadelphia. His voluminous published works include: *Topography, Climate, and Diseases of Cincinnati* (1810); *Notices Concerning Cincinnati* (1810; 1908); *Practical Treatise on the History, Prevention, and Treatment of Epidemic Cholera* (1832); *Practical Essays on Medical Education* (1832); *Systematic Treatise on the Principal Diseases of the Interior Valley of North America* (1850-54); *Pioneer Life in Kentucky*, ed. by his son (1870). Consult *Mansfield, Life of Daniel Drake* (Cincinnati, 1855).

**DRAKE, SIR FRANCIS** (c.1545-96). An English admiral and navigator, born at Crowndale, near Tavistock, in Devonshire. He was apprenticed at an early age to a sea captain and later engaged in the coasting trade for a few years. In 1565-66 Drake extended the field of his operations to Guinea and the Spanish Main. In 1567-68 he commanded a ship in the last expedition of Hawkins against the Spaniards, which ended so disastrously. After this he made two voyages to the West Indies, undertaken for the purpose of obtaining information preparatory to the execution of a plan of revenge for Hawkins's ill-fated squadron. This done, Drake set out on a third voyage in 1572, having with him three ships and 73 men, and with this force captured the Spanish town of Nombre de Dios, on the Isthmus of Panama, with an enormous store of treasure, took a Spanish galleon in the harbor of Cartagena, and burned the town of Porto Bello. Finally, the indefatigable adventurer, with 18 Englishmen and 30 Indians, crossed the Isthmus of Panama and saw the South Sea, praying God that he "might sail once in an English ship in that sea." Laden with spoil, he sailed homeward, and reached Plymouth on Sunday, Aug. 9, 1573. From 1573 to 1576 Drake served in Ireland, but in the latter year his thoughts

turned to the sea, and in December, 1577, he sailed from Plymouth for the Spanish Main with a squadron consisting of his own ship, the *Pelican*, of 100 tons, the *Elizabeth*, of 80 tons, and three smaller vessels. That this expedition against a nominally friendly power was encouraged, if not sanctioned, by Queen Elizabeth, is undoubted. Drake sailed for South America, entered the Río de la Plata, and went south to the Strait of Magellan. After battling with the currents for 16 days he entered the Pacific. A furious storm separated the fleet. The *Elizabeth* returned to England, another vessel was lost with all on board, and the *Pelican*—renamed the *Golden Hind*—was alone left to explore the unknown Pacific. The voyage was a series of successful exploits. The Spanish towns on the coasts of Chile and Peru were sacked, and a treasure ship was captured. Drake then steered for the northeast, hoping to find a passage back to the Atlantic, but, finding his crew unwilling to encounter the cold of the high latitudes, he turned south and refitted his ships in a small harbor just north of the Golden Gate, receiving the homage of the natives in the name of Queen Elizabeth. He then steered across the Pacific, touched probably at what are the Pelew Islands and at Ternate, in the Moluccas, and after many hazardous experiences anchored off the southwest coast of Java on March 10, 1580. Thence he struck across the Indian Ocean, doubled the Cape of Good Hope on June 15, and finally arrived at Plymouth in late September, 1580, laden with treasure and spices. Queen Elizabeth sanctioned Drake's "reprisals," visited the *Golden Hind*, and knighted her bold commander.

Between 1581 and 1585 Drake was mayor of Plymouth, and during a part of the year 1585 and the whole of 1586 he commanded a fleet of 21 ships in a successful plundering expedition against the Spanish West Indies. From the West Indies and Florida Drake made his way up the coast to Virginia, whence he sailed for England, taking with him the disheartened Raleigh colonists whom he had found at Roanoke. It is said that he brought back to England on this voyage both the potato and the tobacco leaf. In the spring of 1587 Drake was sent with a fleet to raid the formidable Armada which Philip was collecting for the invasion of England. He entered the harbor of Cadiz, destroyed the fleet in the roadsteads (10,000 tons), secured much booty, and withdrew to plunder the coast towns, destroying ships and fortifications as he went. From the Spanish coast he sailed for the Azores in the hope of meeting any homeward-bound ships and was fortunate enough to secure a Portuguese East Indiaman with a precious cargo, the first intimation England had of the vast possibilities in the East India trade. He strongly urged the Queen and her ministers to follow up the blow already given Spain without allowing her time to recuperate, but the expedition in which he planned to repeat his Cadiz exploit was foiled by contrary winds. He returned to Plymouth and, on the arrival of the Spanish Armada, served as vice admiral under Lord Howard in the fighting which resulted in the defeat of the Spanish fleet. The story is told that he kept Lord Howard from putting to sea until they had finished their game of bowls, saying: "There's plenty of time to win the game and thrash the Spaniards too." The wreck of the

great Armada quieted all fears of invasion in England, and by way of reprisal a fleet was sent under Drake and Sir John Norreys to the coasts of Spain and Portugal in the spring of 1589. A large amount of booty was taken, and the enemy's stores and shipping were so effectually destroyed as to prevent all possibility of a future attempt against England. A few years of quiet were followed, in 1595, by an expedition to the West Indies. The Spaniards had received intelligence of the attempt, and the Englishmen were repulsed in an attack upon Porto Rico and other places. Drake died off Porto Bello, Jan. 28, 1596. Consult: Corbett, *Drake and the Tudor Navy* (London, 1898); id., *Sir Francis Drake*, in "English Men of Action Series" (ib., 1890). The intensely interesting original narrations of Drake's exploits may be found in the Hakluyt volumes (ib., 1848, 1850, and 1865); in Arber, *An English Garner*, No. 5 (7th ed., Birmingham, 1880-83); and in the *Camden Miscellany*, vol. v (London, 1863).

**DRAKE, FRANCIS SAMUEL** (1828-85). An American author, born at Northwood, N. H., the son of Samuel Gardner Drake. His most important work is his *Dictionary of American Biography* (1872), containing 10,000 biographies, nearly all prepared by himself. He also wrote: *Life of General Henry Knox* (1873); *The Town of Roxbury* (1878); *Indian History for Young Folks* (1884); and contributed to Winsor's *Memorial History of Boston* (1880-82).

**DRAKE, FRIEDRICH JOHANN** (1805-82). A German sculptor. He was born at Pyrmont, June 23, 1805, the son of a mechanic and served an apprenticeship in cabinetwork. His talent in clay modeling attracted the attention of Dr. Mundhenke, a relative of Rauch, who in 1827 obtained for him admission into the sculptor's atelier. Drake also studied (1836-37) in Italy where he came under the influence of Thorvaldsen, but Rauch was his principal master, and his first works were executed under Rauch's directions. The best of them is a group of a "Dying Warrior" (1833), crowned laurel of victory; a "Madonna and Child," bought by the King of Prussia; and a graceful statue of a "Female Vine Dresser" (Ministry of Justice). His early works also include a series of excellent portrait statuettes of Goethe, Schiller, Rauch, the two Humboldts, and other celebrities. In 1836 he modeled the colossal bronze statue of Justus Möser, a German patriot, for Osnabrück, and in 1844 he completed the plaster statues of the eight "Provinces of Prussia" for the White Hall in the Royal Palace of Berlin. Among his best works is the marble statue of Frederick William III in the Thiergarten, Berlin; the frieze crowning the circular pedestal, 18 feet in height, represents the enjoyment of nature and is one of the most graceful works of modern sculpture. Noteworthy among his other works is the noble marble statue of Christian Rauch, in the vestibule of the New Museum, Berlin; another of the sculptor Schinkel (1869), and a marble group on the Schlossbrücke representing a "Warrior Crowned by Victory" (1857). Perhaps the most important of all his monumental works is the colossal bronze statue of Emperor William I (1867), now on the new Hohenzollern Bridge at Cologne. At the Paris exhibition of 1867, this monument was adjudged the most remarkable work of modern sculpture and brought to the sculptor the cross of the Legion

of Honor. His latest works include the "Victory" on the Siegessäule, Berlin, the colossal bronze statue of Alexander von Humboldt in Philadelphia, and busts of Bismarck and Von Moltke. Drake is one of the foremost representatives of the German school of sculpture of the nineteenth century. His art is manly and strong, and not without a high appreciation of beauty of form. But he never quite emancipated himself from the semiclassical influence of Rauch, whose lofty simplicity always remained his ideal. In his portrait work he renders the character of the subject in its most attractive features, but without idealization. He was highly regarded by contemporaries, having been professor of the Academy of Berlin and member of the academies in Munich, St. Petersburg, Antwerp, Rome, and Paris. He died in Berlin. Consult Lübke, *History of Sculpture*, vol. ii (London, 1872), and Heinrich, *Rauch, Rietschel und Drake* (Basel, 1884).

**DRAKE, JOSEPH RODMAN** (1795-1820). An American poet. He is chiefly remembered for his poems "The American Flag" and "The Culprit Fay," and for the eulogy by his friend Halleck (see HALLECK, FITZ-GREENE), beginning "Green be the turf above thee." Drake was born in New York City, was early left an orphan, and had a hard struggle in his first years. He managed, however, to study medicine, graduating in 1816, and the same year married the daughter of Henry Eckford, a shipbuilder, much to the bettering of his circumstances. The same year also he wrote "The Culprit Fay," his longest work, a fanciful poem which aimed to show that American rivers were not unadapted to romance and romantic treatment. In 1818 he went to Europe and on his return wrote a series of verse satires for the New York *Evening Post* on current events. They were done in conjunction with Halleck and are generally known as *The Croakers*. The verses were distinctly witty and very popular. In 1819 Drake went to New Orleans to recover his health, but the following year he died of consumption in New York. *The Culprit Fay and Other Poems* (including "The American Flag") was published in 1835. There have been two later editions. The *Croaker* verses were collected in 1860.

**DRAKE, NATHAN** (1766-1836). An English physician and author. He was born at York and was educated at Edinburgh University. After a short residence at Sudbury he removed, in 1792, to Hadleigh, Suffolk, where he became prominently known as a physician and essayist. He was a versatile and very prolific author. His more important works include: *Shakespeare and his Times* (1817), in which the accumulated material of previous editions and annotations was for the first time collated and presented in its entirety; and *On the Use of Digitalis in Consumption* (five papers published in the *Medical and Physical Journal*, London, 1799-1800). His *Literary Hours* (1798) were exceedingly popular early in the nineteenth century (4th ed., 1820).

**DRAKE, SAMUEL ADAMS** (1833-1905). An American editor and author, born in Boston. Upon the outbreak of the Civil War he became inspector and adjutant general of the Kansas militia and in 1864 brigadier general. He wrote *Around the Hub* (1891); *New England Legend and Folk-Lore* (1884); *The Making of New England* (1886); *The Making of the Great West*



(1887); *The Making of the Ohio Valley States* (1894); *The Watch Fires of '76* (1895); *Myths and Fables of To-Day* (1900); *On Plymouth Rock* (1898; 1904); *The Young Vigilantes* (1904).

**DRAKE, SAMUEL GARDNER** (1798-1875). An eminent American antiquarian. He was born in Pittsfield, N. H., was educated in the common schools, and from 1818 to 1825 taught in a district school. In 1828 he went to Boston, where he established an antiquarian bookstore—the first of its kind in the United States—and devoted himself to the study of early Massachusetts history. He was one of the founders (1847) of the New England Historical and Genealogical Society, was its president in 1858, and for many years was the editor of its quarterly *Register*. He published works on Indian history: *Indian Biography* (1832; 15th ed., under the title *The American Races of North America*, 1880); *Indian Captivities* (1839); besides the *History and Antiquities of Boston* (1856); *Annals of Witchcraft in the United States* (1869); *History of the French and Indian War* (1870). He also edited Church's *Entertaining History of King Philip's War* (1825); Mather's *Indian War of 1675-76* (1862); *Early History of New England* (1864); Hubbard's *Indian Wars* (1865).

**DRAKENBORCH, drä'ken-börk, ARNOLD** (1684-1748). A Dutch classical scholar. He was born at Utrecht, Netherlands, and, after studying there and at Leyden, succeeded Burmann as professor of history and eloquence at the University of Utrecht (1716). His chief publications are an edition of Silius Italicus (1717), and his masterpiece, an edition of Livy (1738-46), which, though lacking in definite method, contains much valuable material and is still often cited. His *Dissertatio de Præfectis Urbi* (1704) was reprinted with a biography of the author in 1752 (Frankfort).

**DRAKENSBERG, drä'kens-bërg.** A mountain range of South Africa, running through the eastern part of the Province of the Cape of Good Hope, along the eastern frontier of Orange Free State, and forming part of the northwest frontier of Natal (Map: Orange River Colony, K 6). It forms the eastern rampart of the South African plateau, being steep on the side facing the sea, but with a gradual slope on the inland side. The highest peaks are Mont-aux-Sources, Champagne Castle—both estimated altitudes of 10,500 to 12,000 feet—and Giants' Castle (9600 feet). Its two passes of Van Reenan (5400 feet) and Laing's Nek (4100 feet) are crossed by railways. This region was the scene of numerous battles between the Boers and the British.

**DRAKE UNIVERSITY.** A nonsectarian, coeducational institution in Des Moines, Iowa. It was founded in 1881, largely through the beneficence of Francis M. Drake, George T. Carpenter, and D. R. Lucas. The management of the university is vested in a board of trustees which will in the course of time number 25 members. The departments represented are those of liberal arts, law, education, Bible, and fine arts; there are also summer schools, and various training schools operated in connection with the university. The degrees conferred by the college and graduate schools include B.A., B.Ph., B.S., B.D., M.A., M.S., LL.B. In 1913 the institution had 80 instructors and 1594 students. The library contains about 26,000

volumes. The presidents of the university and their terms of service have been as follows: George T. Carpenter (1881-93), Barton O. Aylesworth (1893-97), William B. Craig (1897-1902), and Hill M. Bell (1902- ).

**DRAM.** See DRACHMA.

**DRAMA** (Lat., from Gk. *δρᾶμα*, from *δρᾶν*, *dran*, to act). A form of literary art designed for the direct representation of human actions and characters, through their impersonation by actors before an audience. Though many modern plays have been written in prose, the drama is historically classified as a department of poetry, side by side with the epic and the lyric. The former of these describes events in the narrative form; the latter is the detached expression of individual emotion. Both of these elements may enter into the drama in a subordinate way, but in dramatic poetry the facts of a story are actually developed upon the stage in the interchange of speech and action. It is the action, too, which distinguishes the drama from simple dialogue, in which the persons are mere mouthpieces for the expression of ideas. The drama brings into play every emotion which can be objectively expressed, whether by word or gesture or play of feature, or what the modern playwright describes as "business." The illusion of reality is heightened by the efforts of the scene painter and the stage manager, which, however, belong to the technical side of dramatic art. See THEATRE.

The division of a play into acts and scenes, however (see ACT), is a usage . . . . . the subject matter of the drama . . . . . the invention of the drop curtain and scene-shifting accessories make it seem to some extent an affair of mechanical adaptation. The several acts mark different stages in the development of the theme, successively introducing the characters and elements of the plot, showing the complications which led to its climax, and finally solving its problem by the "catastrophe." The natural changes of background commonly coincide with the changes of acts. The succession of scenes (subdivisions of acts) usually depends, in a classical play, upon the entrance or exit of important characters.

The same double consideration underlies the famous doctrine of the "unities," which are in part a formulation of the inevitable restrictions of the stage. They are traced to some of Aristotle's remarks on tragedy, in his *Poetics*, but they were most definitely accepted as conventions of the theatre by the classical French dramatists, Racine and his successors. The "dramatic unities" are three—of place, of time, and of action. The first precludes any extensive change of scene. The second requires that all the events of the play must occur within the space of one day. Unity of action demands that all the incidents of the play shall converge upon the development of a single plot. Of these three rules, modern criticism, with Lessing and the French Romanticists, and according to Shakespeare's practice, is generally agreed in regarding the last as the only one which is fundamental; the others are due primarily to accidental conditions which no longer prevail. Upon the Greek stage, the model for the Classicists, since there was no curtain and very little possibility for change of scene, unity of place was practically inevitable, though even this was not maintained without exception. Unity of time was rendered almost equally necessary



by the habitual presence of the chorus throughout the play, which would be an evident absurdity if the plot were carried across long intervals of time; the same would generally be true if the same chorus were to appear successively in different places. What is called unity of action, however, is simply an application of the principle which demands unity of impression in the work of any art. Only when subordinate to this last "unity" do those of time and place demand consideration upon the modern stage; though it is undoubtedly true that realism of impression is aided if the imagination is not taxed with wide gaps in either time or place.

The question of unity is often practically involved in the creation of a double plot, the secondary or under plot being concerned with the interests of subsidiary characters in the play. This, by way of contrast and relief, may really serve the effectiveness of the main action.

The classic departments of the drama are tragedy and comedy, terms which have come down to us from the Greeks. The essential distinction has been said to lie in the fact that a tragedy has a sad ending, while comedy ends happily; but this is far from expressing all the difference. Tragedy deals in a serious way with serious themes, especially the deeper sufferings of humanity. Comedy exploits the follies and absurdities of the ridiculous and the base. While all drama is intended to entertain, tragedy does it through the excitement of sympathy, comedy through the excitement of mirth. A satirical purpose, however, may dictate the choice of the object of ridicule. The under-plot also, in a tragedy, often introduces a comic element by way of counterpoise to the tragic emotions excited by the principal plot, and of contrast to heighten the impressiveness of the latter; this is one, e.g., of the effects in the grave-digging scene in *Hamlet*. Diversity of plot, however, is much more to be found in modern than in ancient plays. Many species of drama, too, do not fall into the regular categories of either tragedy or comedy. The so-called historical and romantic dramas are sufficiently defined by their names; the *melodrama*, in Italy a form of opera, has become a species of melodrama, and comedy, broadly treated and including the less critical emotions; in France has been defined the sort of play which is named specifically *le drame*, described variously as *tragédie bourgeoise* or *comédie larmoyante*, and representing life with little limitation as to form. (On the musical drama, see OPERA.) Comedy has developed several special varieties, from the "comedy of manners" of the eighteenth century to farce and burlesque and vaudeville (q.v.); the pantomime and ballet (q.v.) are relatively ancient offshoots from the regular drama, if they do not in some cases form part of its origin.

Mimicry, which is fundamental to the acted drama, is of course a part of human nature, and is doubtless to be found among all peoples. In many forms of literature, too, the dramatic tendency appears. Thus, the Old Testament contains dramatic dialogue, as in the Book of Job, and dramatic lyrics, as in the Canticles; they are to be distinguished, however, from developed drama. Regular dramatic history begins in Greece.

Greek Drama, both tragedy and comedy, developed in connection with the worship of Diony-

sus. (See BACCHUS.) In the Dionysiac festivals of Attica the satyr followers of the wine god were impersonated by choruses of men half clad in goatskins—whence probably we have the word tragedy (*τραγῶς*, a goat, and *τραγῳδία*, goat-song)—chanting dithyrambic songs of the life of the god as they danced about the altar. Thus, about 600 B.C. the poet Arion, at Corinth, led his cyclic chorus of 50. A half century later came Thespis, of Attica, whose Thespian innovation was the introduction of an actor to fill the intervals of singing with stories and mimicry and short dialogues with the leader of the chorus. In time the more serious performances came to be limited to the sadder parts of the Dionysus story and of other tales in the familiar mythology. When Pisistratus established at Athens the winter festival of the *Lenææ*, as at the *Great Dionysia* somewhat later, prize dramatic contests were included in honor of the god, and the development of tragedy was continued by Chœrilus, Phrynichus, and other playwrights. It is to the great tragic writers of the fifth century B.C., however, that the Athenian stage owes its fame. Æschylus enlarged the possibilities of the drama by increasing the number of actors to two. Sophocles added a third. The original dithyrambic chorus of 50 men had been divided into four of 12 each (later increased to 15 by Sophocles), with the custom of presenting plays in groups of four, called tetralogies. In one play of each tetralogy the original satyric form was maintained. The other three, the trilogy, properly formed a consecutive series upon a single legend. A tragedy, in general, was made up of a series of "episodes," separated by lyric passages sung by the chorus, the whole introduced by the prologue and terminated by the "exode." During the festival play after play was given the whole day through. The actors were trained by the author himself, so that to "teach" a drama or a chorus became the regular phrase going out a play. The expenses of the ; however, were borne by a chosen citizen known as the "choregus," who thus participated in the contest. All dramatic representation was under the control of the state. On the external form of dramatic representation in the great theatre of Dionysus, the masks, costumes, etc., see THEATRE.

The Athenian tragedy was not a mere entertainment, but a serious religious function. Its motive, as defined by Aristotle in his *Poetics*, was to purify the passions of fear and pity through the exalted exercise of them. Characterizations of the "great tragic trio" of Athens have been innumerable, from the time of Aristophanes down. In the dramas of Æschylus the idea of *Nemesis*, divine vengeance, which lies at the heart of Greek tragedy, is an overwhelming mystery. In Sophocles it is visibly a part of the moral law of life, while in Euripides it becomes more simply a source of human sadness. The difference in the attitudes of these three great poets, who were so nearly contemporaneous, is typical of the whole progress of Greek tragedy. Beginning as a popular religious festival, it became a vehicle of expression for some of the deepest solemnities of Greek religious thought and then gradually was secularized and lost its vitality. Ion, Achaüs, Agathon, and other writers who succeeded the great period, are of confessed inferiority, and none of their works have come down to us.

With the dropping of the chorus much of the lyrical element was lost. From being an Athenian institution tragedy spread to other Greek towns, and from the Dionysiac festivals it was extended to others, till its special relation to the worship of Dionysus disappeared. The earlier works were continually reproduced, however, and at Alexandria, under the Ptolemies, tragedy shared in the general revival of literature and the arts.

The development of Greek comedy was parallel with that of tragedy. The name is derived from *κῶμος*, a band of revelers, or from *κῶμη*, a village, with *ὄδῃ*, a song. The rude jests with which the songs of the more rustic Dionysus festivals were enlivened led naturally to a dramatic composition of the same character. Susarion, of Megara, is said to have introduced comedy into Attica early in the sixth century B.C., but before it was encouraged at Athens it came to a considerable development elsewhere, particularly among the Dorians of Sicily, where flourished Epicharmus and Sophron, the inventor of mimes. The history of Athenian comedy is familiarly divided into the three periods of the Old, Middle, and New Comedy. The best-known writers of the first were Cratinus, Crates, Eupolis, and Aristophanes, who is its great exemplar. Organized in a manner similar to tragedy, but with a chorus of 24 and an additional element called the *parabasis*, in which the audience was directly addressed, it dealt frankly in personalities, was largely political, and did not hesitate to caricature the leading men of the day. Middle Comedy marks the beginning of a period when freedom of speech was less unlimited, and when the follies and foibles of whole classes rather than of individuals furnished the butt of the comedian's ridicule. The chorus lost its connection with the drama and was dropped. In the so-called New Comedy of Menander and Philemon, at the beginning of the third century B.C., the tendency seems to have been brought to its logical development. Instead of to political questions of the day, the comic writer devoted himself to the exhibition of ridiculous complications of social life, in a society which with its simplicity had lost much of its virtue. Types were developed which are still familiar upon the stage, such as the gullible old man, the dissipated son, and the tricky and impudent servant, who may be called a sort of male prototype of the soubrette. This later Greek comedy is chiefly known to us through the adaptations of the Roman comedians Plautus and Terence.

By the end of the third century B.C. Greek drama had ceased, and was not revived till the middle of the eighteenth and beginning of the nineteenth century. With the stiffening of the national will which preceded the Greek struggle for independence, dialogues of a patriotic nature appeared. This tendency took definite shape in the plays of J. R. Nerulos (1778-1850), who was active in the political affairs that led to the revolution, and whose writings did much to pave the way for modern Greek literature. Several other Greek writers joined him in the early nineteenth century in the attempt to rouse the patriotism of the people by means of the theatre. Their work is important only as pioneer work, but its vigor and enthusiasm inspire hope for the future of the drama in Greece.

**Roman Drama.** Comedy appears to have been the sort of poetry most natural to the

Romans, who had not, on the whole, great dramatic gifts. Comic elements existed in the *saturæ* of the early Latin towns. Yet the Romans borrowed, according to the common account, their first idea of a play, during a period of national despondency (364 B.C., Livy, vii, 2), from the Etruscans, from whom came their word *histrion*, an actor (whence our "histrionic"); the effusions of sportive humor in the rude farces known as *fabulæ Atellanæ* came to them from the Oscans; those called mimes they took from Magna Græcia; their literary drama was almost wholly an imitation of the Greek. The drama was one of the earliest branches of literature to be cultivated at Rome. There were both comedies and tragedies by Livius Andronicus, Nævius, and Ennius, and tragedies by Pacuvius and Attius, besides others less known, all patterned after Greek originals, but practically none of these works have come down to us. Nævius is celebrated for having got into trouble by ridiculing prominent people in imitation, it is said, of the Old Comedy at Athens. Practically all we have of Roman comedy belongs to the works of Plautus and Terence, of the class called *palliata*, closely adhering to their Greek models in scene and subject, in distinction from the so-called *togata*, which had Roman subjects. Plautus was once a poor day laborer; Terence a Carthaginian slave; and the style of each is characteristic. Plautus has a degree of rough vigor and broad jocularity, while Terence is more refined and delicate in his wit and characterization. Both these writers based their work upon the New Comedy of the school of Menander and Philemon. One of the chief forms is to be noted in particular: the *prologus* ceased to be the first act of the play and became the species of detached explanation which it has since remained.

Tragedy, more as literature than for acting upon the stage, continued to be cultivated by many of the writers of the Augustan age and later, with the expressed ambition of rivaling the Greeks. Of all these attempts, however, we have only the 10 rhetorical dramas which are credited to the philosopher Seneca, though they are certainly not all his. One of them, the *Octavia*, is of the class called *prætextæ*, with Roman historical subjects; the others are all from Greek mythology. With the general decline of popular taste under the Empire, all "legitimate" drama fell into decline, and the stage was held by dancers and pantomimes, some of whom became immensely popular favorites. The most celebrated of Roman actors is Roscius, to whose excellence Cicero testifies.

**Indian Drama.** Another national drama which has been said to be derived from that of the Greeks is that of India; this, however, is a disputed point, and Indian drama is now generally thought to be of independent growth. Like the Greek, it arose in a religious connection, along with the dances and songs of the popular festivals. The Hindu drama, however, has no tragedy and makes far more of the motive of romantic love than does that of the Greeks. Kalidasa, one of the earliest names in its history, as well as the greatest, has been commonly assigned to the first century B.C., but recent criticism places him several centuries later. The best period of Sanskrit drama, then, was from about the fourth to the ninth century A.D. A peculiar feature of the Indian plays, though not without some Greek parallel, is the use of different dialects for different characters.

Gods and heroes and men of high position speak Sanskrit; women and men of low rank speak various forms of Prakrit.

The best-known Sanskrit play is the *Sakuntala* of Kalidasa. It was translated by Sir William Jones in 1789 and is an heroic love drama of great beauty. Kalidasa is also the author of a five-act play called *Vikramorvasi* ('The Hero and the Nymph'). Next in importance among Hindu dramatists was Bhavabhuti, a Brahman of southern India in the eighth century; two of his three plays concern the adventures of Rama, the hero of the epic *Rāmāyana*, on which, indeed, are founded several of the later Indian dramas. Two other noted plays are the *Mricchakatika* ('The Toy Cart'), a drama of social life, in 10 acts, credited to a king named Sudraka, of the sixth century, and *Ratnavali* ('The Pearl Necklace'), a romantic piece supposed to have been written by King Sriharsha, of the seventh century. With the coming of the Mohammedans, the drama in India gradually declined, and, though Sanskrit plays have been written in modern days, they are rarely acted.

**Chinese Drama.** The only other Oriental branch of the drama that is imparted is the Chinese, which, in spite of the antiquity of other Chinese literature, is comparatively modern. There are reasons for thinking it to have been derived from the Tatars, though it has commonly been considered an evolution from the native songs and dances. In the eighth century A.D. a sort of academy of music, known as the "Pear Garden," was founded by an emperor of the T'ang dynasty. Drama proper did not develop till about the thirteenth century. Its best period is considered that of the Yuen dynasty, ending in the fourteenth century; but perhaps the most famous of all Chinese plays is the one called *Pi Pa Chi* ('Story of the Guitar'), of a somewhat later period. There are many printed collections of plays, but these differ materially from their acted versions. The avowed aims of the Chinese drama are of the most elevated sort, glorifying all the virtues. The pieces themselves are generally rather arid and conventional; as acted, they include much interpolated matter, such as to give reason, perhaps, for the low esteem in which actors are held. Chinese plays are broadly classified, not as tragedies and comedies, but as "civil" or "military." The latter include combats and violent deeds of all sorts. The former are quieter and deal with the more ordinary aspects of social life, with a tendency to the comic. There is little attempt at realism or stage setting. Women's parts are taken by men. Whole series of pieces are commonly performed without intermission—a fact which has led to statements as to the extraordinary length of Chinese plays.

**Japanese Drama.** The Japanese drama bears somewhat the same relation to the Chinese as the Roman did to the Greek; it is largely an importation, though in the process of adaptation it has struck roots into the soil and taken on a semblance at least of independent life. But conditions in Japan are not such as to foster a vigorous dramatic growth. The drama is wholly divorced from literature and consequently occupies a very low position in the esteem of the better classes. Until recently both actor and dramatist were held in contempt. This situation has been somewhat relieved, however, by the dramatic reform association, and scholars, the purpose

of which is to elevate the drama to the position it occupies in other civilized countries.

**Aboriginal American Drama.** The only drama of importance developed among the native civilizations of America was the so-called Inca drama of Peru, of which only a single fragment has been preserved.

**Mediæval Drama.** Europe during the Middle Ages saw dramatic progress in one direction. Many of the Christian Fathers condemned dramatic exhibitions of all kinds, but the Church as a whole, more practical, undertook to offset the pagan shows by a Christianized equivalent. This seems to have arisen naturally, out of the responsive chants and narrations of biblical events with which the congregations were both instructed and entertained, and which in time came to be a regular liturgical drama, developing into the *miracle plays* (q.v.), and *mysteries* (q.v.), and *passion plays* (q.v.), which at Oberammergau and elsewhere have come down to our own day. With a similar purpose arose also the *moralities* (q.v.), which were often rendered by wandering churchmen. Out of such beginnings, varied somewhat by occasional secular tendencies (see *FARCE*), modern drama may be said to have promised to develop, when the Renaissance came with a new impulse.

**Italian Drama.** In Italy, where the revival of the classical type was earliest, the religious drama reached a considerable degree of literary progress before it was superseded. The fifteenth century saw the development of the so-called *Rappresentazione Sacra*, produced chiefly in connection with the festivities in honor of St. John the Baptist. Notable among these are the *Abramo e Isacco* (1449) of Feo Belcari and Lorenzo de' Medici's *San Giovanni* and *San Paolo*.

The modern history of the drama in Italy, passing by less regular attempts like that of Poliziano, is considered to begin with Trissino's *Sofonisba* (1515), a dull and conventional tragedy in blank verse. About the same time Plautine comedy was revived in the writings of Cardinal Bibbiena, Ariosto, and Machiavelli. Tasso's *Aminta* (1573) set a fashion of pastoral drama which was much imitated. Towards the end of the century Giambattista della Porta, playwright as well as philosopher, exhibited a number of comedies of a familiar and sometimes even farcical kind, but of an agreeable originality. The political influence of Spain was now at its height on Italian territory, and the romantic drama of the West gradually found favor in Italy. Borghini, Michelangelo Buonarroti, nephew of the great artist, and other writers continued the reaction against the domination of the classic taste; notable in the movement were Buonarroti's comedies, *Tancia* (1612) and *Piera* (1618). About the beginning of the seventeenth century, too, Rinuccini and others, by the union of music with the romantic drama, succeeded in establishing what was called *melodrama*. Regular tragedy and comedy were well-nigh superseded, and all Italy turned to the *musica opera*. Zeno, a century later, fixed the musical drama on a literary level, and in it Metastasio, whose popularity was established by the performance in Rome (1723) of his *Didone Abbandonata*, completely fascinated the Italian public. His long series of works culminated in the triumph of his *Atilio Regolo* (1750).

Meanwhile, however, the regular drama had been revived. The archaeologist Maffei composed his *Merope* (1713), with the definite purpose

of restoring the classic tragedy to Italy. The political preponderance of Spain had now given way to that of France, and Maffei's friend, the actor playwright Riccoboni, contributed not a little to the consequent increase of French influence upon the Italian stage. The other foremost names of the eighteenth century in Italian drama are those of Goldoni (1707-93), Gozzi (1722-1806), and Alfieri (1749-1803). Goldoni, who left his native Venice in 1761 to complete his life in Paris, has been called "the Italian Molière"; he is the great Italian exemplar of regular literary comedy. His great rival, Carlo Gozzi, won fame in quite a different style. Taking the popular institution of the *commedia dell' arte* ('comedy of masks'), for which Goldoni expressed contempt, he gave it a literary form which for a few years enjoyed immense success. The bold and passionate Alfieri inaugurated a new era in Italian tragedy. He was a follower of the classic school, an observer of the unities, and aimed, while writing such tragedies as *Filippo II*, *Saul*, and *La Congiura de' Pazzi*, to help revive the vigor of the national spirit. His successors, among them Monti, Niccolini, Manzoni, Silvio Pellico, and, later, Cossa, somewhat relaxed their adherence to classic forms; in the nineteenth century Italy shared in the extending influence of Shakespearean methods. The dramatists thus affected have given prominence to historical drama, and some of their works have been of a high order. In recent years the novelist and poet D'Annunzio has gained some distinction as a playwright, with poetic dramas written for the actress Duse. It would scarcely be an exaggeration to say that for the past century the influence of the Italian actors has been greater than that of the dramatists. Since the renovation of the stage through the efforts of G. Modena (1804-61) Italy, with the possible exception of France, took first rank in the art of acting; and in the art of tragic acting she surpassed even France. In the past century Ristori, Rossi, Salvini, and Duse have all won international reputations.

**Spanish Drama.** The great period of the Spanish drama came earlier than did that of Italy and at a time when the best poets, while writing for the stage, still busied their pens in the composition of religious dramas in the service of the church. Passing over some of the earlier names—among them those of Santillana, Lope de Rueda, who, as actor, manager, and playwright, has been called the "Patriarch of the Spanish Stage," and his follower Naharro—we come to the century of Cervantes, Lope de Vega, and Calderón. The genius of Cervantes was more decidedly epic than dramatic. Yet in *La Numancia* he has left a serious tragedy of permanent worth and dignity. Contemporary with him were the lesser writers Cueva, Virués, and Argensola. While the critics, however, were clamoring about the classic rules of the drama, Lope de Vega appeared upon the scene, to set nearly all the laws at defiance. He was a writer of the most prodigious facility as well as dramatic vigor. More than 1800 plays are said to have been his work, and he won immense popularity, to which, indeed, he sacrificed some of the more enduring qualities. Of the same period were Ruiz de Alarcón and Tirso de Molina (Gabriel Tellez), whose *Burlador de Sevilla, ó el convidado de piedra* is a play notable for having introduced the famous character of Don Juan. Calderón, who succeeded to the greatness of

Lope de Vega, had the additional merit of serious devotion to dramatic art. The lyric element is prominent in his plays, and they include many of the highest expressions of Spanish ideals, of devotion to the King, to the church, and to personal "honor." Famous among his creations were the religious plays called *autos sacramentales*, in which the mystery of the Eucharist was dramatically set forth. With his death, in 1681, the brilliant period of the Spanish theatre was nearly closed. His contemporary Moreto wrote numerous fine comedies, notably the "cloak and sword plays," for which the Spanish stage is proverbial; and the name of the historian Solís is worthy of mention. But with the decline of the national spirit, which began about the close of the seventeenth century, the art of drama fell into decay; and during almost the whole of the eighteenth century the Spanish theatre was under the domination of French influence. The dramatists of the nineteenth century succeeded in emancipating themselves from this influence so far as form was concerned, but continued to imitate the French romantic school in their choice of subjects. They produced, therefore, little that was original or that reflected the national life. The best-known dramatists of the twentieth century are J. Echegaray and Menéndez Sierra.

**Portuguese Drama.** With minor exceptions Portuguese drama follows Spanish in the course of its development. The most renowned writer of the early period was Gil Vicente, who wrote in imitation of De la Engima, the founder of Spanish drama. His plays were produced in the years 1502-36 and achieved wide popularity. Following him, F. de Sá de Miranda attempted to introduce a type of play imitated from the Italian comedy of intrigue, but failed of popular success, though his plays possessed greater literary merit than those of Gil Vicente. In the eighteenth century Alino Mycenio and Lycidas Cynthio are the only names of importance. The notable nineteenth-century dramatists are Pereira de Cunha, Cordeiro, Biester, Palmeirín, and De Amorim.

**French Drama.** France, in the revival of the classical drama, accepted the "unities" as the first essentials in the drama. This was in great part owing to the logical temper of the national genius. Previous to Jodelle, or, indeed, to Corneille, hardly any drama had been made in regular dramatic form. A number of writers had produced *mystères*, *moralités*, *sotties*, *farces*, in which in numerous instances the romantic or anticlassical tendencies of human nature had manifested themselves; but neither in the representations of the *Confrères de la passion* nor more secular performances like those of the *Enfants sans Soucy* was there any great advance in proper dramatic achievement. Jodelle, at the court of Henri II, was the first to exhibit a regular five-act tragedy. He composed other pieces of some merit, but nothing of any great importance to the drama was done in the half century that succeeded. Corneille appeared in the reign of Louis XIII during the time that the star of Richelieu was in the ascendant; he had to humor the court by humoring the Academy, and to please the Academy he was required to observe the rules of Aristotle. He had produced several plays of a severe elegance and dignity of style, when inspiration came to his more romantic tendencies in the Spanish story of the *Cid*. All Paris rang with the praises of

this play; but the French Academy, acting on the suggestion of Richelieu, took occasion to censure it on the ground that it violated the classical "unities." Corneille, who was ambitious of election to the Academy, carefully avoided giving similar offense afterward. The final establishment of the rule of the three "unities" was largely due to his acquiescence, though it is obvious from his work that he never felt quite at home within the limitations he had imposed on himself. He obtained, however, the position in the Academy which he coveted. It was in Molière, a contemporary of Corneille, that French drama found its highest expression. This was partly due to Molière's own genius and partly to the fact that the spirit of the French people may be better rendered in comedy than in tragedy. Unlike Corneille, Molière sought to portray the life about him, especially such phases of it as lent themselves to humor or satire. He had led a varied life, living in Paris, where his father held a subordinate post in the King's household (to which Molière nominally succeeded) and traveling in the provinces as a strolling actor, so that he had ample opportunity to observe at first hand the wide variety of characters with whom he later peopled his plays. Before his time French comedy had been content merely to provoke laughter; he lifted it from this position and made of it a rich and varied commentary on life. The favorite tragic poet of the court of Louis XIV was Racine. His powers lay decidedly in the region of the serious and the exalted, so that he had no temptation, like Corneille, to pass the bounds of the academic proprieties. In tenderness and elegance all French writers yield to him; in his *Athalie*, his last and best drama, interpreted by the actors Baron and Madame Champmeslé, he gave to the Parisian public a composition such as in breadth, elegance, and severe grandeur it could nowhere find apart from the Greek theatre. Passing by Boursault and the other lesser writers who saw the decline of Racine and Molière, and such artists on the stage as Adrienne Lecouvreur, Lekain, and Mademoiselle Clairon, we come to the brilliant and erratic Voltaire. He astonished Europe with the force and power of his romantic tragedies, in a style of composition which, since the *Cid*, had been excluded from the theatre. The intolerant iconoclasm of his warfare with superstition was perhaps too distinctly revealed in his dramas, but his genius and spirit have earned for him a place beside the great tragic names of Corneille and Racine. Among the writers of the period that followed were Lemercier and Chénier, whose tragedy of *Charles IX*, played by Talma, led to the division of the Comédie Française, while among the other famous actors at the national theatre were Mademoiselle Dumesnil, Monvel, and his daughter, Mademoiselle Mars.

In the nineteenth century the drama of France has been more productive than that of any other nation. Notable among the writers of the century are Alfred de Vigny, Scribe, and Legouvé, who collaborated in a large number of successful pieces, Dumas père, and Victor Hugo—leaders of the "romantic movement," the battle over which converged about Hugo's *Hernani* in 1830—Alfred de Musset, Emile Augier, Dumas fils, Victorien Sardou, Octave Feuillet, Eugène Labiche, Meilhac and Halévy, Emile Zola, and more recently Edmond Rostand, who has very successfully revived the poetical play. No sketch of the

French drama can overlook the services of an institution like the Comédie Française (q.v.) in maintaining the literary qualities of the stage and encouraging its support by the leading writers of the nation, while artists like Mademoiselle Rachel, Sarah Bernhardt, and Constant Coquelin have often been better known than the authors whose lines they spoke. It is too early to speak with assurance of the drama of the twentieth century, but if early indications are to be trusted France promises to maintain her position of prééminence. A host of new writers have come forward and are already well known throughout Europe and America. Chief among these are Maurice Maeterlinck, Paul Hervieu, Maurice Donnay, Jules Lemaitre, and Eugène Brieux. Their work differs widely, but they all, with the exception of Maeterlinck, show the influence of the naturalist movement which began with the founding of the Théâtre Libre in 1887.

**German Drama.** The German drama is almost wholly dependent for its fame upon the names of Lessing, Goethe, and Schiller. For while Hans Sachs, Ayser, and some others showed ability and some fertility, and while Gryphius, Gottsched, Gellert, and Schlegel made advances in the appreciation of the laws of dramatic composition, yet through the end of the seventeenth and the beginning of the eighteenth centuries the German theatre was little more than a feeble reflex of French influence. Lessing, however, taught Germany to appreciate the productions of the romantic drama, both by his creations and by his criticisms. His *Miss Sara Sampson*, his comedy *Minna von Barnhelm*, and his later tragedies opened a new era for the German drama, while in his *Hamburgische Dramaturgie* he attacked French classicism, praised Shakespeare, and professed his adherence to the principles of Aristotle. Goethe, his great successor, is without doubt one of the world's foremost geniuses; but he was poet and philosopher rather than dramatist. His *Faust* must always retain its place as one of the greatest of modern compositions; but his chief purpose was complete self-cultivation, and in the prologue to this, his last and by far his most famous production, he sets forth why, although writing in the dramatic form, he could not altogether accommodate himself to the demands of a popular theatre. Schiller was more expressly the dramatic poet of Germany than Goethe. While Goethe's genius was fuller and more complete, Schiller made up for what he wanted in breadth of vision by the practical intensity of his powers. From his wild play of *Die Räuber* down to his last drama of *Wilhelm Tell*, he worked with a vehemence that made an enduring impression upon the national theatre. The demands for a more popular drama were supplied by such writers as A. W. Iffland and August von Kotzebue, both of whom sought to supply effective plays for the stage and were indifferent to the demands of art. In the early nineteenth century a group of Romantics, under the leadership of the Schlegels, sprang into prominence, but their vogue was short-lived. The most successful dramatist of this period was the Austrian Franz Grillparzer, whose best work was done from 1819 to 1830. The German drama of the last quarter of the nineteenth century and the beginning of the twentieth, like most modern drama, is characterized by extreme naturalism, though some of it is written in verse. The leading contemporary dramatists are Hermann Sudermann and Gerhart Hauptmann.

**Dutch, Scandinavian, and Belgian Drama.** Among the Dutch the drama has had but slight independent growth. In the sixteenth and seventeenth centuries Van den Vondel and others participated in the dramatic revival that followed the Renaissance; but the later Dutch stage largely imitated that of France. The first important dramatist of the Scandinavian countries was the eighteenth-century Danish poet Holberg. He was one of the first comic poets of his day, and his plays did much to supplant the trivial German and French importations common on the Danish stage. Like Molière, he chose his characters and subject matter from the life about him and ridiculed with unsparing directness the vices and follies of his time. Following him, Oehlenschläger, in the first half of the nineteenth century, inaugurated a new era in Danish drama by the production of a series of plays dealing with subjects from Norse mythology. But by far the most significant development in Scandinavian drama—in all contemporary drama, perhaps—came towards the end of the nineteenth century. Its chief promoters were the two Norwegians, Ibsen and Björnson, and the Swede Strindberg. Of the three Ibsen's influence has been much the greatest. It is to him largely that we owe the modern social drama. He did not originate the type, but his example and influence gave it currency and helped to fix it in popular favor. Strindberg, who was a much more prolific and in some respects a more powerful writer, is little known outside his own country; but his work seems to be gaining in favor in spite of its morbid tone and generally melancholy aspect. In Belgium, which has been counted, from an artistic point of view, as a province of France, the most noted work of recent years has been that of the poet Maeterlinck, whose plays have served as an extreme type of some of the features of the Symbolist movement.

**Russian Drama.** Russia has been somewhat slower in developing a national drama than the other European countries. Dramatic representations of a sort began at an early period, but regular plays were not performed before the middle of the eighteenth century. Sumarokov, who was born in 1718 and died in 1777, was the first regular dramatist. He wrote tragedies in imitation of Racine and Voltaire and translated *Hamlet* into Russian. He also wrote comedy, in which he had several noteworthy followers. The Empress Catharine II herself tried her hand at satirical comedy and also wrote a tragedy in imitation of Shakespeare. To the nineteenth century belong Griboyedoff, the author of *Gore at Uama* ("The Misfortune of Being too Clever"); Gogol, whose comedy *Revizor* ("The Inspector") made a great sensation; Pushkin, whose *Boris Godunoff* shows the change from French to Shakespearean influence; and Tolstoy, who wrote plays, though he is better known as novelist and philosopher; and Ostrovski, a writer of numerous comedies.

**English Drama.** In England, as elsewhere, the early dramatic exhibitions were connected with the church. Ecclesiastics were at first not only the authors but the actors of the miracle-plays and mysteries by which religious instruction was combined with a good deal of grotesque amusement. The moralities, in which abstract qualities were personified, marked an imaginative advance, and the early comedy was to some extent an evolution from them, through the gradual substitution of real and strongly char-

acterized persons for mere abstractions. But the main influence towards comedy came from the imitation of classic models. *Ralph Roister Doister*, usually considered the earliest English comedy, was little more than an imitation of the *Miles Gloriosus* of Plautus. The same thing may be said of most of the early comedies. They were either adaptations from, or direct imitations of, classical and Italian plays. A few years after *Ralph Roister Doister* appeared the first tragedy, called *Gorboduc*, or *Ferrex and Porrex*, a dull and declamatory production in blank verse by Sackville and Norton. From this time dramatic production was rapid, though at first without great improvement. To pass by the names of Bishop Still and of Kyd, Lodge, Lyly, Peele, Green, and Nash, mention is due to Christopher Marlowe as the greatest of Shakespeare's predecessors. He is the author who first introduced upon the public stage blank verse, the vehicle of English drama, and there are passages in his tragedies of *Doctor Faustus* and *Edward II* which are accounted not unworthy of Shakespeare himself.

But all these earlier playwrights are obscured by their nearness to the great luminary of the English drama. Shakespeare is almost universally acknowledged to have been the greatest dramatic genius that has appeared in the world. Disregarding or ignorant of the "unities" and the artificialities of a stage as yet unaided by any but the most primitive scenic accessories, he brought the romantic drama to its highest perfection. His writings present the finest example of the depth, sublimity, refinement, and variety of which the drama is capable; and they are abundantly marked by those peculiar characteristics which sprang from the union in their author of such wonderful powers of conception with such familiar experience of theatrical management. (For a more detailed discussion of his plays, see the special article SHAKESPEARE.) Of the other actors of Shakespeare's time we know less; but Burbage and Alleyn are among those whose names have come down to us. Among dramatists the best of Shakespeare's contemporaries were Ben Jonson, Beaumont, and Fletcher. Like Shakespeare, Jonson wrote both comedies and tragedies, but he showed more of the influence of the classic models. Milton speaks of "Jonson's learned sock" and thus in a phrase hits off the main feature of his character as a dramatist. Yet he was famous in the composition of such light and graceful pieces as the masques in which the court found entertainment. (See MASQUE.) Beaumont and Fletcher, who were joint workers, have the honor of standing next to Shakespeare in the romantic drama of England; but, like Lope de Vega, they wrote too much for the success of the moment to be ranked in the foremost file of England's dramatic writers. With Dekker, Massinger, Ford, Webster, Chapman, and Shirley, the older English drama is closed, sharply terminated by the Puritan Revolution.

With the Restoration came a dramatic representation much more the child of the court and in its form largely reflecting French influence. Under the direction of such managers as Davenant and Killigrew plays were much more elaborately staged than before, and the drama was very much better patronized. On the stage were Betterton and Mrs. Barry. The chief literary figure of the time was Dryden, who wrote successfully both tragedy and comedy. The trag-



edies of Lee and the unfortunate Otway, with such comedies as those of Shadwell and Wycherley, bring the history of the drama down to Vanbrugh, Congreve, and Farquhar, writers whose brilliant depiction of the externals of society is clouded by an immorality and an indecency even more marked than that of some of Shakespeare's immediate successors. Gay and Mrs. Centlivre, and the actor playwright Colley Cibber, displayed in their comedies considerable dramatic spirit and invention. Of quite another sort was Addison's tragedy of *Cato*, famous in the annals of literature and successful on the stage for the old-fashioned political virtues which it solemnly set forth. Lillo, Moore, Garrick the actor, Goldsmith, the Colmans, and Cumberland nearly all took to prose instead of verse. They produced agreeable comedies; but, except Goldsmith's *She Stoops to Conquer* and one or two other pieces, nothing very important appears in the history of the drama till the time of Sheridan, who gave an impulse to "high" comedy such as has placed him ever since at the head of the writers of that species of composition. Famous among the favorites of the stage meanwhile had been "Peg" Woffington and Katharine Clive.

Sheridan's immediate successors—Holcroft, "Monk" Lewis, Maturin, Mrs. Inchbald, and others—have left little that is remembered; but such interpreters of the drama as John Kemble, Mrs. Siddons, and later Edmund Kean, save the period from unimportance in dramatic history. Joanna Baillie, the poets Byron and Coleridge, and Henry Taylor, wrote fine meditative dramas, little suited, however, for actual presentation upon the stage; and the same may be said of much of the more recent dramatic poetry of Tennyson, Browning, and Swinburne. The list of writers for the English theatre in the nineteenth century is long. Among the earlier ones Sheridan Knowles and Bulwer-Lytton wrote plays which are still known on the boards. Later came Talfourd, Jerrold, Shirley Brooks, Tom Taylor—who wrote over 100 pieces, many of them very popular—Marston, Wills, Charles Reade—who, with Boucicault or alone, dramatized several of his own works—T. W. Robertson, H. J. Byron, Sydney Grundy, Oscar Wilde, W. S. Gilbert—who is best known, however, for the comic operas in which he collaborated with Arthur Sullivan—H. A. Jones, A. W. Pinero, Hadson Chambers, J. M. Barrie, H. V. Esmond, and Stephen Phillips. Not to be neglected also in our account is the important influence of such actor managers as Macready, Buckstone, the Bancrofts, Sir Henry Irving (to whose company belongs Ellen Terry), and Sir Charles Wyndham, in giving direction to dramatic production. Of the more recent dramatists who have come into prominence Shaw, Galsworthy, Granville Barker, and Somerset Maugham are the most noteworthy. Shaw in particular, since the beginning of the century, has risen to a position of international importance.

**American Drama.** The American stage was naturally in its origin a mere dependent upon that of England; and the sameness of language, the similarity of dramatic themes, and the constant interchange of English and American actors still make it difficult to separate the drama of the United States from that of Great Britain. At the present day American successes are reproduced in England hardly less than successful English plays on this side. In-

dependent dramatic production in America, however, as an infant industry labored under one particular disadvantage, owing to the absence till 1891 of an international copyright. A manager could always adapt, translate, or reproduce outright, at no expense and little risk, a play that had met success abroad; whereas to purchase one from a native writer involved at the outset a definite outlay and the subsequent risk of failure. Partly in consequence of this, dramatic history in America has had to do more with players than with playwrights. Yet the literature of the drama in the United States is extensive, though, as in England, much of it is of little value. Not a little of that belonging to the years which followed the Revolutionary War consisted of trashy pieces for the exploitation of crude patriotism; and forth the yet unseasoned glories of its achievements. It had been only a few years before the Revolution that the first permanent playhouse was built—the Southwark Theatre in Philadelphia (1766)—followed the next year by the opening of the John Street Theatre in New York. Here in 1787 was presented what is considered the first play by an American author regularly produced upon the stage—*The Contrast*, written by Royall Tyler, afterward Chief Justice of Vermont. It has been asserted, however, that Godfrey's *Prince of Parthia* was acted in Philadelphia some 20 years before. The dramatic qualities of *The Contrast* were of the slightest, but it served to introduce to the boards the personage known as the exaggerated "Yankee," who could not be banished for three-quarters of a century. The first prolific American dramatist was William Dunlap, some of whose work was fair for the period. He produced about 50 plays, a few of them translated from the German. The opening of the Park Theatre, New York (1798), gave a new impulse to the drama, although the chief players were from the old country and the opening play was *As You Like It*. Here, in 1809, "the American Roscius" made his début as Young Norval. This lad was John Howard Payne. He not only appeared with great success in this country and in England, but he wrote and translated a number of plays, of which his own *Brutus*, or *the Fall of Tarquin*, still keeps the stage. It is a well-constructed tragedy and is the first drama of importance written by an American author.

It was not until about 1820 that literary and cultured people began to look with favor upon the drama. In that year the great tragedian Edmund Kean visited America and played in New York and Philadelphia. Ten years later came his son Charles. The great and erratic Junius Brutus Booth first appeared in the United States in 1821; he came again in 1833. Macready made his first visit in 1826. Clara Fisher came in 1827. The season of 1832-33 brought over Charles and Fanny Kemble, who enjoyed an immense popularity. Meanwhile the elder Kean was hardly gone after his second visit when Edwin Forrest appeared in New York in the Shakespearean part of Othello (1826). Forrest is held in memory by many as the greatest of American tragedians. While doubtless at his best in Shakespearean tragedy, he was always intensely American in feeling and undertook to infuse the native idea into his work. John A. Stone's *Metamora* was written for him, as was also R. N. Bird's tragedy of *The Gladiator*. One of the most popular of For-



rest's contemporaries was the comedian James H. Hackett, who became famous as Falstaff and in "Yankee" rôles. John Gilbert made his début in Boston in 1828, and later ripened into one of the most accomplished actors of "old man" parts on any stage. William E. Burton came to the United States in 1834. Charles Burke, one of the finest of American comedians, began his short career in 1836. He was a half brother of Joseph Jefferson, who about the same time made his appearance as a boy upon the stage and subsequently more than realized the promise of his theatrical ancestry. Already Charlotte Cushman, celebrated as the greatest of American actresses, had begun to show her power. In 1838 Mary Cecilia Taylor made her début and soon became a popular favorite, a clever and versatile though not a great actress. Still the stage was largely dependent on English materials when John Brougham came over in 1842. He was the first author to put life into the playbills, besides being one of the best comedians of the day, and, though he was born an Irishman, his work was essentially American, especially his inimitable burlesques, *Pocahontas* and *Columbus*. In 1845 the elder John Drew appeared in America. Meanwhile Anna Cora Mowatt was becoming the reigning favorite in genteel comedy and light tragedy, and in 1848 she appeared in England with E. L. Davenport, who had already at home made a reputation as a versatile actor.

During the second half of the century just passed the annals of the American stage offer a long list of names worthy of respect as those of gifted and admirably trained artists. In tragedy it is necessary only to recall Edwin Forrest, who still played till after 1870; John McCullough, best remembered for his manly impersonation of Virginius; Edwin Booth and Lawrence Barrett, two of the most scholarly of American actors; and Richard Mansfield, who was not only a tragedian, but a successful actor in other branches of the regular drama. In legitimate comedy John Gilbert and Joseph Jefferson led the way, and were followed by Lester Wallack, E. A. Sothern, William Davidge, William J. Florence, James Lewis, John T. Raymond, Sol Smith Russell, John Drew, and N. C. Goodwin. In lighter comedy and farce some of the names suggesting themselves are those of William H. Crane, Neil Burgess, Henry E. Dixey, and Francis Wilson. Of the talented and accomplished women who have graced the stage, Charlotte Cushman was still the foremost a half century ago. Among the others most noted have been Mrs. Anne Gilbert, who at her eightieth birthday (in 1901) was still playing; Elizabeth Crocker Bowers, Maggie Mitchell, Matilda Heron, Laura Keane, "Lotta" Crabtree, Rose Coghlan, Clara Morris, Fanny Davenport, Mary Anderson, Ada Rehan, Minnie Maddern Fiske, Annie Russell, Julia Marlowe, Mrs. Leslie Carter, and Maude Adams. A continually increasing number of well-known foreign actors and actresses have made American tours; some of them, like Madame Jansauschek and the late Dion Boucicault, the playwright, made America their home.

The list of American dramatists not already referred to includes Harrigan and Hart, Augustin Daly, Lester Wallack, Bronson Howard, James A. Herne, H. C. De Mille, Denman Thompson, David Belasco, Clyde Fitch, Augustus

Thomas, William Gillette, William Vaughan Moody, Charles Klein, Eugene Walter, Percy Mackaye, George M. Cohan, and Edward M. Sheldon.

For a fuller treatment of matters relating to the drama, the reader is referred to the articles that deal with the individual actors and authors mentioned above, and to those entitled THEATRE; BALLET; BURLESQUE; CHORUS; CLAUQUE; COMÉDIE FRANÇAISE; FARCE; INTERLUDE; MASQUE; MIRACLE PLAYS; MYSTERY; PANTOMIME; ETC.

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**DRAMA LEAGUE OF AMERICA.** An organization started in Evanston, Ill., in 1910. It spread rapidly and now embraces practically all the principal cities of the United States. The purpose of the league is to encourage good plays by pledging the support of the members during the first 10 days after production and by . . . . . and educating an intelligent play-going audience that will be nation-wide, thus insuring the success of all worthy plays and creating a higher standard of dramatic art. Realizing that the success or failure of most plays is determined the first few days after production, the playgoing committee of the league visits all plays produced and sends out a bulletin of information concerning those deemed worthy of support. This bulletin is mailed to all members of the league in the city or "dramatic centre" where the play is being given, and contains brief but definite information concerning the theme, plot, dialogue, characters, and other details of the production. Plays deemed unworthy of support are not condemned, but ignored. Recently an attempt has been made to extend the movement to Canada and Great Britain.

**DRAMATIC ARTS, AMERICAN ACADEMY OF.** . . . . . l for the stage, established by . . . . . in New York City in 1884 and chartered by the regents of the State of New York in 1889. It offers a two years' course of systematic instruction. In 1897 the Empire Theatre Dramatic School was placed under the management of the Academy. The senior class offers several public performances.

**DRAMATIC MUSIC.** See OPERA.

**DRAMATIC POESY, AN ESSAY ON.** A treatise (1667) by Dryden in the form of a dialogue.

**DRAMMEN**, drām'men. A seaport town of Norway, situated on the Drammen Fjord, at its entrance into the Drammen Fjord, an arm of the Christiania Fjord, 33 miles southwest of Christiania (Map: Norway, D 7). The town occupies a site between high hills and has been rebuilt since the fires in 1866, 1870, and 1880. The three quarters of the town, which are divided by the river, are joined by bridges. Drammen manufactures chiefly lumber; also ironwork, tobacco, cellulose, paper, cotton, and woolen textiles. It has saw mills and shipyards and exports much lumber, zinc, nickel, and cobalt. Its trade is largely with England and Holland.

Near by are large salmon fisheries. Pop., 1902, 23,091.

**DRAPER, ANDREW SLOAN** (1848-1913). An American educator; also a lawyer. He was born at Westford, N. Y., graduated in 1871 from the Albany Law School, and until 1885 practiced in Albany, except for a year when he served in the State Assembly. In 1885-86 he was a member of the Court of Commissioners of Alabama Claims, afterward until 1892 he was New York State Superintendent of Public Instruction, in 1892-94 he had charge of Cleveland (Ohio) schools, and for 10 years he was president of the University of Illinois. Appointed in 1904 first State Commissioner of Education for New York, he served in this position until his death. For some time he was also chairman of the Board of United States Indian Commissioners. At the Paris Exposition of 1900 he was awarded a silver medal for a monograph on *The Organization and Administration of the American School System*, and at St. Louis in 1904 he received one of the two grand prizes for unusual services to the cause of education. His publications include: *American Schools and American Citizenship* (1891); *Public School Pioneering in New York and Massachusetts* (1892); *Conserving Childhood* (1909); *Holiday Papers* (1912). He was also editor in chief of *Self-Culture for Young People* (10 vols., 1906).

**DRAPER, DANIEL** (1841- ). An American born in New York City, a son of John William Draper, under whom he studied science. He obtained his degree from the University of the City of New York. He helped his brother, Henry Draper, to construct the telescopes, grind the mirrors, and build his observatory at Hastings-on-the-Hudson. From 1869 to 1911 he served as director of the New York Meteorological Observatory. The self-recording meteorological instruments employed in that institution are based chiefly upon his designs. Among his literary contributions to science may be mentioned the well-known treatise on the *Cause of Pneumonia*, which has also been translated and reprinted abroad.

**DRAPER, EBEN SUMNER** (1858-1914). An American Republican leader and manufacturer of textile machinery. He was born at Hopedale, Mass., and was educated at Massachusetts Institute of Technology. He became a member of the firm of George Draper & Sons in 1880 and selling agent of the Draper Company in 1896, was chosen a director of various banks and cotton-manufacturing corporations, and became president of the Manville Company and vice president of the Massachusetts Hospital Life Insurance Company. He was chairman of the Republican State Committee (1892) and of the Republican delegation to the Republican National Convention (1896) and was presidential elector (1900). From 1906 to 1908 he was Lieutenant Governor, and from 1909 to 1911 Governor, of Massachusetts.

**DRAPER, HENRY** (1837-82). An American scientist, the son of John William Draper. He was born in Prince Edward Co., Va., studied in New York from 1852 to 1854, and began the practice of medicine in 1858. He was then professor of physiology in New York University from 1860 to 1866, professor in the medical school from 1866 to 1873, and afterward professor of chemistry. He constructed large telescopes and devoted himself to celestial photography, rendering important service to astronomy

and astrophysics. The continuation of his spectroscopic investigation of the stars, which was cut short by his death, was provided for by the endowment of the Draper Memorial at Harvard College Observatory by his widow in 1886. He published *On the Construction of the Silvered Glass Telescope* (1864; 1904) and *A Text-Book on Chemistry* (1866).

**DRAPER, JOHN CHRISTOPHER** (1835-85). An American physician, born in Virginia. He was a son of John William Draper. He entered the academic department of New York University in 1852, but subsequently abandoned the study of the classics, attended the course in medicine, and graduated in 1857. He was professor of analytical chemistry, New York University (1858-61), of chemistry at Cooper Union, New York City (1860-63), of natural science at the College of the City of New York (1863-85), and of chemistry in the medical department of New York University (1866-85). He contributed numerous articles to medical and scientific journals, was editor, in 1872-73, of the *Year-Book of Nature and Science*, and for three years had charge of the department of natural science in *Scribner's Monthly*. His important works include: *The Production of Urea* (1856); *Experiments on Respiration* (1856); *Text-Book on Anatomy, Physiology, and Hygiene* (1866); *A Practical Laboratory Course in Medical Chemistry* (1882); *Text-Book of Medical Physics* (1885).

**DRAPER, JOHN WILLIAM** (1811-82). An American chemist, physiologist, and philosophical writer. He was born near Liverpool, England, and was educated at a Wesleyan school at Woodhouse Grove and at London University. In 1831 he joined some of his relatives who had emigrated to America, and in 1836 took his degree of M.D. in the University of Pennsylvania and was appointed professor of natural philosophy, chemistry, and physiology in Hampden-Sidney College, Virginia. In 1839 he removed to New York, where he was connected with the college department of the University of the City of New York; and in 1841 joined Drs. Mott, Patterson, and others in founding the medical school of New York University, in which he was at first professor of chemistry and after 1850 of physiology. He was the first president (1876) of the American Chemical Society. He published: *Treatise on the Forces which Produce Organization in Plants* (1844); *Text-Book of Chemistry* (1846); *Text-Book of Natural Philosophy* (1847); *Human Physiology, Statical and Dynamical: or, the Conditions and Course of Life of Man* (1856).

Dr. Draper's lasting contributions to physiology and to pure chemistry were few and relatively unimportant. On the other hand, his name is associated with a number of results of the greatest value in physical chemistry, especially in photochemistry (q.v.). The chemical action of light early attracted his attention and for many years formed his favorite subject of investigation. He succeeded in demonstrating that different colors of light have an unequal influence on the decomposition of carbonic acid by the green pigment of plants. The spectra of light emitted by incandescent substances engaged his attention as early as 1847, and his memoirs show that at that early date he had already grasped the wonderful possibilities of spectrum analysis, in both chemistry and astronomy. He further succeeded in showing that

all parts of the spectrum, the invisible as well as the visible ones, are capable of chemical action. His improvements in the art of photography entitle him to an eminent place among the great inventors of the nineteenth century. The principle of photography was established by the Frenchman Daguerre; but Daguerre's process was imperfect and practically incapable of useful application. It was Draper's improvements that rendered it possible to apply photography to the representation of the human countenance, and the first photograph was taken by Draper in 1839, in the old building of the New York University. A valuable collection of Draper's publications was published in 1878, under the title *Scientific Memoirs: Being Experimental Contributions to a Knowledge of Radiant Energy*.

Though a lifelong teacher of science and a prolific writer on scientific subjects, Draper will perhaps best be remembered as the author of three works which more properly belong to the domain of philosophical history. The first of these and the most important is *The History of the Intellectual Development of Europe* (2 vols., 1863), in which he attempts to apply the methods of science to human history and to prove inductively that "social advancement is as completely under the control of natural law as is bodily growth." Much of his data, both scientific and historical, has been superseded, and some of his conclusions are discredited, but the work is characterized by considerable erudition and a remarkable clearness of presentation, and is still much read. His *History of the American Civil War* (3 vols., 1867-70), though it gives a graphic and fairly accurate account of the military operations, is chiefly valuable for its elaborate analysis of the causes, immediate and remote, which made a war between the North and the South inevitable. The most popular of his works, however, is his *History of the Conflict between Religion and Science* (New York, 1874), a candid, philosophical, and fairly comprehensive treatment of the subject. Consult Barker's "Memoir," in vol. ii of the *Bio-graphical Memoirs of the National Academy of Sciences* (1886).

**DRAPER, LYMAN COPELAND** (1815-91). An American historian and educator. He was born at Hamburg (now Evans), Erie Co., N. Y., and was educated at Granville College (now Denison University), Ohio. In 1840 he conceived the idea of writing a history of the Indian wars of the United States and with this in view visited many pioneers, Indian chiefs, and others who were in any way identified with the early Indian civilization. He continued these investigations for 25 years, traveling thousands of miles through every part of the United States. The information thus compiled is said to have covered a period from about the middle of the eighteenth century to the death of Tecumseh. From 1854 to 1887 he was secretary of the Historical Society of Wisconsin and practically became the founder of the extensive library of that society, which upon his accession was limited to only a few volumes. The results of his extensive tours to collect material on the early history of Wisconsin were published in the first 10 volumes of the *Wisconsin Historical Collections*, which he edited. Unfortunately only a few of the works projected by him were completed at his death. Among those published are *Madison, the Capital of Wisconsin, and its*

*Heroes* (1857) and *King's Mountain and its Heroes* (1881).

**DRAPER, WILLIAM HENRY** (1801-77). A Canadian statesman and jurist, born in London, England. As a boy, he ran away to sea to serve on an East Indianman. He came to Upper Canada when 19 years old, taught school at Port Hope, studied law, and was called to the bar. His professional success, especially before juries, was heightened by a winning presence and persuasive ability as a speaker. In 1836 he was elected a Conservative member of the Upper Canada Assembly and was appointed a member of the Executive Council without portfolio. At that time the Executive Council was not responsible to the Assembly, a condition which had brought the Reformers in Upper Canada to the point of rebellion. (See *POLITICAL PARTIES, Canada*.) Draper had little sympathy with them, his temperament and political principles alike being opposed to an extension of popular rule. In 1837 he was appointed Solicitor-General and in 1840 Attorney-General, but at the request of Lord Sydenham, the first Governor under the Act of Union of 1841, he entered the administration formed under that act as Attorney-General for Upper Canada. His position as member of a cabinet avowedly based upon the newly vindicated principle of responsible government was anomalous, even though the principle at that time was imperfectly understood. Some of his ministerial associates widely differed from him, notably Robert Baldwin (q.v.). Draper found it necessary, first, to represent the Conservative element in a cabinet whose members should have been of the same political complexion; also, to state and defend the conditions on which responsible government could be made acceptable to the Conservative party. The latter task, ably but unsuccessfully attempted, henceforth determined his political course. He soon resigned and in 1842 was appointed a member of the Legislative Council. When Sir Charles (afterward Baron) Metcalfe (q.v.) became Governor, Draper became his chief adviser; but the Governor's firm persistence in autocratic methods left the country without a ministry for the greater part of a year until the more important offices were filled. Draper resigned from the Legislative Council and was elected to the Assembly in order that he might more effectively defend his policy. In 1844 the general elections had been in his favor. He became Premier, but after a trying tenure of office, during which some of his political associates turned against him, he retired in 1847. A long and enviable career of more than 30 years still remained to him as jurist. He was appointed a puisne judge of the Court of Queen's Bench in 1847; in 1856 he became Chief Justice of the Common Pleas, in 1863 Chief Justice of Upper Canada, and in 1869 Chief Justice of Error and Appeal. In 1857 he was sent to England to represent Canada in the negotiations with the Hudson's Bay Company for the transfer of its rights to Canada. His numerous decisions form a judicial record of great learning and authority. Consult Dent: *Canada since the Union of 1841* (1881).

**DRAPER, WILLIAM HENRY** (1830-1901). An American physician. He graduated from Columbia College in 1851 and four years later from the College of Physicians and Surgeons (Columbia), where he was clinical professor of diseases of the skin from 1869 to 1879. He also

served as . . . . .ian to St. Luke's, Roosevelt, . . . . . hospitals and as visiting physician to the New York Hospital. Besides being one of the founders of the American Dermatological Association, he was president of the Association of American Physicians in 1888. He published a treatise on dermatology.

**DRAPIER LETTERS.** See SWIFT, JONATHAN.

**DRASCHE**, drāsh'e, ANTON (1826-1904). An Austrian physician. He was born at Lobendau, Bohemia, and was educated at Prague, Leipzig, and Vienna. In 1858 he became lecturer on pathology and therapeutics at the University of Vienna, and in 1874 he was appointed extraordinary professor of epidemiology at that institution. During the cholera epidemics of 1850, 1854, 1855, 1866, and 1873 he conducted special hospitals or medical departments for the treatment of patients, and his numerous papers on the treatment of cholera, published chiefly in the *Medizinische Wochenschrift*, are considered valuable contributions to the literature of the subject. He was also an acknowledged authority on diseases of the heart, and the introduction of the tincture of strophanthus into the therapeutics of these diseases is due to his initiative. A collection of his medical treatises was published at Vienna in 1893.

**DRAUGHTS.** See CHECKERS.

**DRAVE**, drāv (Ger. *Drau*). An important affluent of the Danube, rising in the eastern part of Tirol, at a high altitude on the south slope of the main ridge of the Hohe Tauern Alps, and flowing through the Pusterthal towards Lienz, where it is joined by the Isel (Map: Austria-Hungary, F 4). It then flows a little south of east through Carinthia and Styria, passing Villach and Marburg; then, turning towards the southeast, it forms the boundary between Croatia and Slavonia on the right and Hungary on the left, and joins the Danube 10 miles east of Esseg, after a course of 465 miles. Its principal affluent is the Mur, from the left. In the first part of its course the Drave is but a mountain torrent, rushing wildly through the craggy passes of Tirol, but from Villach it is navigable for rafts to its mouth, a distance of 380 miles, and for steamers from Bares, about 100 miles from its mouth. The navigation facilities have been much improved by the government. The valleys through which it flows in its course through Carinthia, Styria, and Croatia are distinguished by great fertility and picturesque scenery, while in Slavonia it is frequently bordered by dense forests. In earlier times the valley formed the road through which the invaders from the East—Huns, Slavs, and Turks—penetrated to western Europe.

**DRAVIDIAN ARCHITECTURE.** A term used by Fergusson and others to designate the Hindu or Brahman architecture of southern India, as seen especially in the temples of Chilambaram, Ramisseram, Madura, Tarpully, Vellore, Perore, Tanjore, Conjeveram, etc., with lofty gopuras (q.v.), corridors, pools, and halls. See INDIAN ART.

**DRAVIDIANS** (Skt. *Drāviḍa*). The name given to a large group of non-Aryan races of southern India, including those speaking Tamil, Telugu, Kanarese, Malayalam, Tulu, Kudagu, and six or eight uncultivated dialects of the ruder tribes, like Tōda, Kōta, Khond, and Gond, together with Orāon and Rājmahāl. The census

of 1901 gives the number of the Dravidian-speaking population as 57,497,982. Geographically the Dravidian population occupies almost the entire peninsular part of India, or that portion to the south of the Vindhya forest and the Nerbudda River, as a glance at the linguistic and racial maps of Cust and Constable will show. (See also INDIA.) The Orāons and the Rājmahāl hill tribes are sporadic representatives of Dravidians in the Province of Bengal to the north. Like the main body to the south, they are remnants left over from an earlier time when the Dravidians occupied a much larger part of India than at present; as a whole, the Dravidian stock has been pushed forward or overrun by the advance of the Aryan incomers from the north. Ethnologically the Dravidians are interesting, especially such a tribe as the Tōdas, in the Nilgiri hills, who represent one of the lowest stages of civilization. In some districts the Dravidians are distinguishable by language rather than by physical characteristics from the neighboring Hindu (Aryan) peoples, while in others they are so dark-skinned and so constituted in hair, features, etc., as to lead some ethnologists to consider them related to the Australians and to group the latter and the former as one race. Some authorities consider the so-called "Kolarian" peoples to be related to the Dravidians, while others look upon them as pre-Dravidian aborigines. The religion of the Dravidians embraces all phases from the rude nature worship of the hill tribes to the borrowed Buddhism, Hinduism, and Islamism of the more civilized peoples. The Dravidians (Tamils) have even developed a style of architecture. The folklore and mythology of some of these peoples is rich and varied, of the Tamils in particular.

The Dravidian languages belong to a group quite independent of the Indo-Germanic (q.v.); the affinities which these tongues show with Sanskrit are due to geographical contact and not to linguistic kinship. Hardly any two of the dozen Dravidian languages are intelligible to those who speak the other, except in a general way. The two which stand highest in cultivation and importance are the Tamil and the Telugu. More than half the number of Dravidian-speaking peoples employ the one or the other of these two vernaculars. The Tamil covers the lower eastern side of the Indian peninsula from Madras to Cape Comorin and over into Ceylon. It is spoken by some 16,525,500 people. The Telugu, which was spoken in 1901 by 20,696,872 persons, adjoins this language to the north and extends from Madras upward beyond the dominions of the Nizam of Hyderabad. The Kanarese, or Canarese, spreads westward from the Telugu district to the sea and is current among some 10,365,047 persons. The Malayalam, spoken by 6,029,304 individuals, runs in a narrow strip down the lower southwestern part of the peninsula, almost from Mangalore to the cape. The language of the Brāhui (q.v.), an Iranian tribe of Baluchistan, seems to belong to the Dravidian group. On the other hand, there is very little evidence in favor of the theory of the affinity of Dravidian to the Burmo-Tibetan and the Australian family of languages.

With regard to Dravidian literature, such works as exist in the several languages are comparatively modern, despite the antiquity of the Dravidian civilization. Hardly one can be said to be more than 1000 years old. The Tamil and the Telugu, in fact, are the only two Dravidian

languages that can be said to have any real literature. Tamil claims to have compositions as old as the legendary sage Agastya, but the treatises and writings attributed to him can hardly be dated prior to the tenth century A.D. Probably not far removed from the same date is the *Kural* of Tiruvalluvar, comprising poetical aphorisms in 1330 distichs (trans. by Ch. Graul, Leipzig, 1865), and likewise the "Cintāmani," a romantic poem of some 15,000 verses, written by an unknown author, or again the ethical poem "Nālādiyār," which has been rendered into English by Pope (Oxford, 1893). Two centuries later the Tamil poet Kambar made a version, or adaptation, of the Sanskrit epic *Rāmāvana*, and again in the sixteenth century there was a literary revival connected with the name of the poet king Ati-Vira-Rāma Pāndya. At the opening of the eighteenth century we find, besides the native Tamil poet Tāyumānavar, the name of a foreigner, the celebrated Italian Jesuit missionary Beschi, who wrote poetry and prose of so excellent a quality as to win him a place in Tamil literature. In more recent times, it may be added, the educational influences of the Madras College have done much for Tamil through translating into it the English Bible and various religious works, and Tamil may be said to possess a future as a vernacular literature. Second comes Telugu, in which the oldest extant poetical work is a version made from the great Sanskrit epic, *Mahābhārata*, by Nannappa, or Nannaya Bhatta, presumably in the twelfth century A.D. Kanarese may also claim the name of a poetical writer, Keśava, who probably belonged to the same century. In the Malayālam language, moreover, there is a poetical account of Rāma, the heroic Prince of India, based upon the Sanskrit, and there are likewise versions of both the greater Sanskrit epics. The other Dravidian languages possess either no literature at all or none worth mentioning.

**Bibliography.** The standard books on Dravidian are the large work by Caldwell, *Comparative Grammar of the Dravidian, or South Indian Family of Languages* (2d ed., London, 1875), and Grierson, "Mundā and Dravidian Languages" (in the *Linguistic Survey of India*, vol. iv, 1906); Forsyth, *Highlands of Central India* (London, 1871); Dalton, *Descriptive Ethnology of Bengal* (Calcutta, 1872); Reclus, *Primitive Folk* (New York, 1890); Kingscote, *Folk-Lore of Southern India* (London, 1890); Oppert, *Original Inhabitants of India* (ib., 1893); Baines, "Ethnography, Castes, and Tribes," in Bühler, *Encyclopædia of Indo-Aryan Research* (Strassburg, 1912, with bibliography); Shilotri, *Indo-Aryan Thought and Culture* (New York, 1913); Thurston, *Omens and Superstitions of Southern India* (London, 1912). For the primitive Dravidian civilization, see the articles of J. F. Hewitt in the *Journal of the Royal Asiatic Society*. There is also a considerable special literature for each of the civilized Dravidian peoples. On the Dravidian languages, consult: Cust, *Modern Languages of the East Indies* (ib., 1878); Hulbert, *Comparative Grammar of the Korean Language and the Dravidian Languages of India* (Seoul, 1906); Hunter, *Comparative Dictionary of the Non-Aryan Languages of India* (London, 1868). For Tamil, consult: Pope, *First Lessons in Tamil* (Oxford, 1891), and other works by the same author, including his English translation

of the "Nālādiyār" (ib., 1893); Hultzsch, *South Indian Inscriptions, Tamil and Sanskrit*, trans. (Madras and Leipzig, 1890-95); Graul, *Tiruvalluvar's Kural*, trans. (Leipzig, 1865). On Telugu: Arden, *Progressive Grammar of the Telugu Language* (Madras, 1873); Brown, *Telugu-English and English-Telugu Dictionary* (ib., 1852-54); Carr, *Collection of Telugu Proverbs* (ib., 1868). On Kanarese or Canarese and Malayālam there are several works published in Mangalore, southern India.

**DRAWBACK.** A term used to designate the repayment of taxes, whether import duties or internal taxes, upon goods which are exported. Drawbacks upon goods imported which are re-shipped in the original packages are rendered unnecessary by the warehouse system, which permits the deposit of goods in bond, without payment of taxes until they are withdrawn either for export or for home consumption, in which latter case the taxes must be paid. If, however, the imported goods are manufactured before the reexportation, drawbacks are necessary if the payment is to be remitted. In the case of goods subject to internal tax the granting of drawbacks on the exportation of the goods serves the purpose of freeing the exporting manufacturer from an increased cost of production through taxation, which his competitors do not have to bear. Great care must be exercised in the mode of assessing the drawback to avoid, on the one hand, taxation and, on the other, a bounty upon exportation. If the amount of the drawback is greater than the tax paid, it becomes a direct encouragement to exportation, which may not be contemplated by the law. It is in this way that the so-called sugar bounties in Germany and some other continental countries arose.

In the United States drawbacks are allowed on imported articles exported for sale abroad, and on firearms, agricultural implements, etc., made of foreign stocks and handles of wood grown in this country, provided the imported materials exceed one-half of the value of the whole material used. Every one entering merchandise for importation or exportation with right of drawback is required to deposit the original invoice of such merchandise with the collector, who causes an inspection to be made by the proper officer and the articles to be compared with their respective invoices before granting the permit for lading. No drawback is allowed on merchandise entitled to debenture under existing laws unless it be exported within three years from the date of importation. Drawbacks are also admitted for the exportation of distilled liquors and manufactured tobacco on which internal-revenue taxes have been paid.

**DRAWBRIDGE.** See BRIDGE.

**DRAWING** (from *draw*, AS., Goth. *dragan*, Icel. *draga*, to drag, probably connected with OHG. *tragan*, Ger. *tragen*, to carry). The delineation of form upon a given surface, usually plane, by means of lines and tints or shades. Painting and drawing are broadly distinguished by the use of varied color in painting, reproducing the colors of the object represented, while in drawing only the form and light and shade (or "modelling") are represented. The forms delineated may be visible objects, forms imagined and presented as if actually seen, or purely arbitrary or abstract forms, as in ornamental patterns and mathe-



matical ". . . . As the delineation of form lies at the foundation of all the plastic arts, drawing is the most important single branch of study in schools of art and of engineering. Since, moreover, the study of drawing trains the faculties of observation and memory to a high degree and develops an effective coordination of the action of hand and eye, it has come to be recognized as of the highest educational value in any system of mental discipline. It is therefore systematically taught in the public schools of nearly all countries that make any pretensions to a well-organized educational system.

The drawing of visible objects is really the graphic recording of mental impressions received through the eye. The draftsman seeks to produce upon the paper, by means of lines and tints, visual images which shall awaken in the beholder mental images and impressions as nearly as possible like those evoked directly by the objects represented. But, since the limitations of drawing in black and white on a plane surface forbid the complete presentation of all the visible facts and aspects of the original object, it is evident that the desired mental impression must be produced largely by *suggestions*, which stimulate the beholder's imagination to supply whatever is lacking in the representation. The drawing, in spite of being merely, e.g., an aggregation of black lines and dots on white paper and but an inch or two in height and width, may so visibly suggest the outline, foliage, masses, light, and shade of a tree, that it evokes in the mind the impressions one experiences in seeing such a tree, and the imagination at once supplies the size, distance, detail, and color which the drawing lacks. Artistic power in drawing consists largely in the ability thus to create by suggestion a vivid impression of reality. A *sketch* is a drawing which attempts to present in a summary way only partial and momentary aspects of the thing represented. An effective sketch is one in which the simplicity and vigor of the artist's personal interpretation of what he sees has not been sacrificed in the effort after elaborate finish. The judicious choice of what to show and what to omit calls for a highly developed taste and can be mastered only by long experience. A master's sketch is worth a score of highly elaborated drawings by 'prentice hands.

**Free-Hand Drawing.** Drawing in which the hand receives no assistance from mechanical appliances is called free-hand drawing. It lies at the foundation of all the arts of plastic design, sculpture not excepted, and constitutes an art in itself. Its greatest masters, like Raphael, Leonardo da Vinci, and Michelangelo, have been among the geniuses of their times. Even the greatness of such colorists as Titian and Veronese depends in large measure upon their consummate draftsmanship. See PAINTING.

The restrictions under which the artist labors in seeking to represent in black and white upon a plane surface the multitudinous aspects of visible objects have already been referred to. The different kinds and schools of drawing are distinguished by the ways in which these restrictions are evaded or overcome. In outline drawings and in some sketches, only the exterior outlines and contours or salient edges and markings of an object or scene are shown. The power which these may have of evoking

complete mental pictures is indicated in the simple outline drawings on Greek vases and by black silhouettes of faces and figures. The power of pure line, even divested of accompanying color, to suggest the most varied modeling of surfaces and to express the minutest detail is admirably exemplified in Chinese and Japanese art. The European schools, on the other hand, lay great stress upon *values*, or the rendering of the varied luminosities and gradations of light and dark in the objects represented, by corresponding gradations of the tones of the drawing; i.e., of the mixtures of black and white produced by the use of the pen and ink, pencil, crayon, charcoal, or sepia brush upon the paper. Even different colors may be to a certain extent suggested, or rather interpreted, in black and white by a careful rendering of their apparent values; a dark red, e.g., being indicated by darker shading than a light blue or a yellow. The great artists of the Renaissance stand midway between the Japanese exponents of pure line and the modern European interpreters of values. Their drawings are wonderful for the purity, vigor, and delicacy of their lines, as well as for the skillful though somewhat conventional rendering of the forms as expressed by . . . . .  
LINE; IMPRESSIONIST SCHOOL OF PAINTING.

**Technic of Free-Hand Drawing.** The fundamental principles of the art are the same, whatever the medium employed. Good drawing demands, first of all, a trained sense, of form, i.e., the power to observe, to understand and appreciate, to remember, and to represent, form in general; or, in other words, the mastery of proportion. In drawing from any object or model the first essential is to observe, and sketch in, the dominant structural lines, contours, and masses, including the conspicuous high lights and deeper shades and shadows. The more important details are next added and corrected, and the minor details are left to the last. In executing these various stages of the drawing lightness of touch and sureness of line are important qualities, attained only by long, and patient discipline. Taste and imagination are both exercised in the choice of what to show and what to omit, while experience alone endows the artist with the knowledge of the most effective methods for expressing the facts and aspects he is seeking to record.

But the detailed technique of drawing varies greatly with the medium employed. The chief instruments are the pencil, pen, black crayon, charcoal, and brush. Of these the pen is the most exacting, since it makes an absolutely black mark on the white paper, and tints must be expressed by dots, closely serried lines, and crosshatching. The masters of pen drawing are invariably masters of pure line. With charcoal or crayon sauce the artist must, as it were, paint on his paper, fine lines being out of the question; so also with the brush, in sepia and other "wash" drawings. The pencil and crayon occupy a middle ground, requiring the use of the line, but permitting broad, soft strokes and stumped or rubbed-in shading. Very effective drawings are made by using a tinted paper—gray or pale blue—on which the high lights are laid on in white with chalk or Chinese white, and the darker shades and masses with the pencil, while the tone of the paper is left to represent the intermediate values. The great masters of the Renaissance,



lacking the "lead" or plumbago pencil, which is a modern invention, used the lead point or a silver point on parchment or heavy paper, giving pale gray line; or, more often, sanguine or red chalk. The quill took the place of the modern steel pen, making a softer and broader stroke.

**Instrumental Drawing.** For scientific purposes, for the working drawings from which buildings and machinery are to be made and erected, and for all purposes requiring great exactitude of representation, a different sort of delineation is necessary from that of the artist working with free hand. Free-hand drawings are personal interpretations of visible form; in this lies their charm. Their value is artistic, not scientific; no two drawings of the same object by different persons, or by the same person at different times, can be absolutely alike. In *mechanical* or *instrumental* drawing, on the other hand, mathematical exactness of line and dimension is secured by the use of various instruments, the most important of these being the T-square, rule, and triangles, used in drawing right lines; compasses for drawing circles and arcs of circles; dividers for laying off exact distances, the scale for determining and measuring dimensions, the protractor for laying off angles, and the ruling pen for drawing clean and faultless lines in ink; besides a considerable number of special appliances which cannot here be enumerated. The object of drawings executed by these means is not to present the aspects of objects as we see them, but to furnish scientifically correct graphic records of the actual proportions and form relations of objects, usually at a much reduced scale. This is effected by means of *projections* upon imaginary vertical and horizontal planes, called *planes of projection*, two dimensions of the object being shown in each projection. These projections comprise *plans*, or top views, showing the object as if seen from an infinite height above; *elevations*, or front, side, and rear views, as if seen from a point infinitely distant horizontally; and *sections*, which show the object as if sliced in two and the nearer half removed, exposing the interior structure. These projections show the correct geometrical relations of the various dimensions and parts of the structure or object, and by the use of two or more projections all its dimensional relations are exhibited. To assist the eye in interpreting these highly conventional drawings—which are really not pictures, but diagrams—they are often (especially in architectural drawings) made with the shadows cast as if by sunlight, falling on the object in each projection at an assumed and uniform angle. This angle is usually so taken that the rays, falling from in front of the vertical plane, downward to the right, are projected at 45° to the ground line on either projection. The delineation of these conventional shadows is a branch of descriptive geometry and has received the name of *sciography* ("shadow writing").

Instrumental drawing is divided, according to its various applications, into *mechanical* drawing, a general term for all engineering drafting; *machine* drawing or the preparation of the working drawings for the construction of machinery; *architectural* drawing, *ship drafting*, *topographical* drawing, etc.; and the various purely mathematical divisions of *descriptive*

*geometry*, *stereotomy*, or the preparations of drawings for cut stonework, *crystallography*, and the like.

In architectural drawing and in most forms of machine drawing and engineering the purpose in view is to furnish diagrams of all parts of a structure or machine to be erected, drawn to exact scale and marked with the proposed dimensions, for the guidance of those who are to execute the work. For this purpose there are prepared as many plans as may be necessary, elevations of the various faces of the structure, and sections showing its internal arrangement. These are all drawn to a small scale, which may be from  $\frac{1}{32}$  of an inch to the foot to  $\frac{1}{4}$  or even  $\frac{1}{2}$  of an inch to the foot (with approximately corresponding scales where the metric system is used). Many of the details of construction are shown in drawings to a larger scale, 1 foot being represented by  $\frac{3}{4}$  of an inch, 1 inch, or even 2 or 3 inches; and there are also prepared a large number of drawings of structural details of the full size of the intended work. At the mills, stoneyards, and shops where much of the work is executed, these drawings are supplemented by *shop drawings* prepared by the several contractors to assist in laying out the work and to serve as exact patterns for its execution. The largest shop drawings are those made in the mold lofts of the shipbuilders, each rib being drawn out to its full size on the smooth floor of the loft. The drawing of decorative details of carving, inlay, and other ornament in architectural work is of necessity chiefly free-hand work and involves an artistic element not called for in the purely scientific drawings above described.

**Perspective Drawing.** Perspective drawing stands midway between free-hand or pictorial drawing and instrumental drawing, since it aims to represent the actual aspect of an object from a given point of view, and yet to do this is a matter less of personal and artistic interpretation than of scientific determination. The object is shown with all the angular distortion and foreshortening which it exhibits to the eye placed at the given point of view; but the exact angles, dimensions, distortions, and foreshortening of each part are determined by mathematical processes and not by mere visual impressions. It thus forms a department of descriptive geometry, but the object is represented, not as projected by parallel lines on two planes of projection, but as projected, by rays converging to the eye, upon an assumed picture plane (or rarely upon a cylindrical or even spherical surface) intersecting these rays and represented by the paper. The picture is absolutely correct only for the eye placed at the given point of view. All parallel lines not parallel to this plane are shown converging to points called *vanishing points*, and parallel planes in like manner converge towards vanishing lines or *traces*. These are all determined by rules and processes too intricate to be here detailed. (See PERSPECTIVE.) There is also a form of angular projection called *isometric* projection, which shows all three dimensions at once, as does a perspective drawing, but with a uniform scale for all parts of the picture, while in true perspective the same actual dimension appears of varying size according to its distance from the eye.

A perspective drawing, thus scientifically laid out as to its outlines, may be finished, as to

line, color, light and shade, and accessories, in a pictorial and artistic manner, as in free-hand drawing; it then emerges from the category of scientific drawing into that of fine art. Indeed, no artist can master the correct portrayal of form, especially of scenery and buildings, without training in perspective; it is accordingly an important branch of study in all schools of art. It is absolutely indispensable to the scene painters and forms the basis of the illusory effects of the stage setting. The artists of the Renaissance were the first to reduce its principles to system, and many of them were carried away by the fascination of its possibilities; the later artists, especially the Venetians (notably Paolo Veronese and later Tiepolo), and the artists of the 19th century employed its resources with great effect; in their great decorative paintings. Japanese drawings are interesting for their treatment of perspective, the point of view being in almost all cases assumed at a high elevation, giving an approximation to the effect of what is called "bird's-eye perspective."

**The Teaching of Drawing.** The delineation of an object actually seen involves, first, *observation*, which comprises perception and attention; secondly, the memorizing or mental *retention* of the visual impression while the eye is momentarily withdrawn from the object to the paper; and thirdly, the *coordination* of the movement of the hand with the outlines of the memorized image. In drawing imaginary forms or designs originating in the artist's mind, a mental image takes the place of the visible object, and imaginative and creative power—the ability to visualize clearly and distinctly in the "mind's eye" these mental images—is an important element in all draftsmanship of the highest order. Skill in drawing is thus in quite as large measure dependent on intellectual factors as on skill of hand, and no system of teaching drawing which confines itself to the mere discipline of hand and eye can be considered as scientifically or philosophically correct. The draftsman draws best what he *knows* best, because well-known forms are those most easily and clearly visualized, so that a thorough acquaintance with the widest range of forms is as essential to consummate draftsmanship as is manual skill in portraying them. Thus it is that constant drawing from life, from nature, from the object, not only gives facility of execution, but, by enlarging the range and increasing the thoroughness of the artist's knowledge of forms, gives him greater resource and a broader grasp of form in general.

Modern systems of teaching drawing to children in the schools generally recognize these principles. The earliest work in the kindergarten and primary grades is such as to stimulate the imaginative and picturing faculty of the child, while he is trained by modeling and weaving into familiarity with the more elementary forms of common things. In subsequent grades the powers of accurate observation are cultivated and disciplined, while manual dexterity is imparted almost insensibly by varied exercises in drawing from leaves, flowers, and still life, and from "flat copies" of ornament forms. In the higher grades drawing from the east, from the antique, and from the living model, in various media, such as charcoal, India ink, and crayon sauce, gives flexibility to the student's powers of artistic ex-

pression and trains his taste in the selection of what to represent and what to reject in his graphic interpretation of what he sees. He is also taught a proper *method*, or procedure, in the making of . . . and learns the correct use of . . . and block outlines, the importance of securing accuracy in the masses before attempting details, and other like principles of correct delineation. In parallel courses, usually in connection with manual training, he has also been taught the elements of mechanical drawing. All these exercises are invaluable for imparting the power of quick, comprehensive, and accurate observation, precision of eye measurements, and dexterity of hand—endowments all of which are useful in the affairs of life, quite apart from any direct application to the fine arts. The detailed methods and sequence of the instruction vary greatly in different systems. Some dwell especially upon nature study; others emphasize the development of form memory; others again make large use of the forms of classic ornament to train at once the eye, the hand, and the taste. In the art schools generally the pupil begins by drawing from the flat copy, then takes up drawing from the antique, i.e., from casts of antique sculpture, and, finally, enters the life class, in which he draws from both nude and draped living models. The criticism has been made that in too many of these schools the teaching follows the routine of apprenticeship methods and lacks philosophical analysis and progressiveness; but this doubtless is not true of the most advanced among them.

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**DRAWING BOARD.** A board on which drawing paper is strained for painting in water colors. The paper is wetted for the purpose of being strained, and, when attached at the edges, it is permitted to dry and contract. Formerly the drawing board was fitted into a frame, the edges of the wet paper being made fast by the pressure of the frame on the board. But the much simpler drawing board which is now in use is made of a flat piece or pieces of wood, held together and prevented from

warping by an edging of other pieces, the grain of which runs in the opposite direction. The wet paper is attached to the edges of the board with paste or thin glue and, when dry, becomes perfectly firm and flat. The same kind of board is used for charcoal or crayon drawing, in which case the paper is merely pinned to the board.

**DRAWPLATE.** A hardened steel plate with a graduated series of holes, through which ductile metals are drawn in making them into wire. See **WIRE**.

**DRAYTON, MICHAEL** (1563-1631). An English poet. He was born in Hartshill, in Warwickshire. Of the events of his life but little is known. He was a page probably in the household of Sir Henry Goodere, of Polesworth, to whom he was indebted for his early education. In 1591 he was in London, although under James he failed in efforts to gain the royal favor. He began his literary career with a metrical rendering of parts of the Bible called *The Harmony of the Church* (1591). The volume was condemned by the authorities, and all but 40 copies of the edition were destroyed. This was followed, in 1593, by nine eclogues with the title *The Shepherd's Garland*, and in 1594 by a series of sonnets, in which was celebrated some unknown woman, under the name *Idea*. Drayton's famous sonnet ("Since there's no help, come let us kiss and part") belongs to a later period. *England's Heroical Epistles* (1597) was a successful imitation of Ovid's *Heroides*. In 1603 appeared a long historical poem, called *The Barons' Wars*, parts of which in another metrical form had been published seven years before. Some of Drayton's very best work—as the *Ballad of Agincourt*—is contained in *Poems, Lyrical and Pastoral* (about 1605). For many years he had been at work on a long . . . . . It was published under the . . . . . (first installment 1613; complete, 1622). Though monotonous as a whole, it contains fine passages. Drayton opened a new vein in the fairy poem *Nimphidia*, one of a collection of poems published in 1627. This new vein was further worked in the 10 *Nymphalls*, in the *Muses' Elysium* (1630). His *Complete Works* were published in 1748. He also collaborated in . . . . . Though much of his work is . . . . . he wrote many choice poems. We have nothing more dainty than his *faeries* and no finer martial ballad than his *Agincourt*. He was buried in Westminster Abbey. The Spenser Society has reprinted *Poems of 1605* (1885-87); *Poems, Lyrical and Pastoral* (1891); *Poly-Olbiion* (1890); *Muses' Elysium* (1892). Consult: selections from the *Poems*, by Morley (London, 1878); by Bullen, privately printed at Chilworth (1883); by Brett (Oxford, 1907); Elton, *Introduction to Drayton* (Manchester, 1895); id., *M. Drayton: A Critical Study* (London, 1906).

**DRAYTON, WILLIAM HENRY** (1742-79). An American Revolutionary patriot. He was born on the family estates in South Carolina, went to England in 1753, with Charles Cotesworth Pinckney and Thomas Pinckney, was educated at Westminster School and at Balliol College, Oxford, returned to South Carolina in 1764, and soon afterward was admitted to the bar. In 1765 he was elected to the Assembly, in which he opposed the nonimportation agreement. In 1769 he wrote, under the signature "Freeman," a series of letters against the "pa-

triotic associations" of the time, which he charged with encroaching on private rights; and largely on this account he was appointed privy councilor for South Carolina in 1771 and assistant justice in 1774. In the latter year, however, he published a vigorous antiministerial pamphlet, entitled *A Letter from "Freeman" of South Carolina to the Deputies of North America, Assembled in the High Court of Congress in Philadelphia*, and for this he was removed from his positions as councilor and judge. He was President of the Council of Safety and of the Provincial Congress of South Carolina in 1775; was made Chief Justice of the State in March, 1776; and in April, 1776, virtually proclaimed the independence of South Carolina on the ground that King George III, having violated American rights, had "by the law of the land . . . abdicated the government," and henceforth had "no authority" in the former Colony. He was acting President of the State for a short time in 1777, during the absence of John Rutledge, and from 1778 until his death was a prominent member of the Continental Congress. He wrote a number of powerful pamphlets and planned a history of the Revolution. A large part of his manuscript was destroyed on the ground that it contained important state secrets, but two volumes survived, covering the history of the Southern Colonies between 1773 and 1776, and these subsequently served as the basis for a work by his son, John Drayton (Governor of South Carolina in 1800-02 and 1808-10), entitled *Memoirs of the American Revolution Relating to the State of South Carolina* (Charleston, 1821).

**DREAMING** (from *dream*, OS. *dröm*, Icel. *draumr*, OHG. *troum*, Ger. *Traum*, dream; probably connected ultimately with OHG. *triogan*, Ger. *trügen*, Skt. *druh*, to deceive, OPers. *drauga*, a lie). In the profoundest sleep there is, so far as we can tell, a total lapse of mentation; the conditions of the formation of a consciousness are not realized. There has been, it is true, much dispute as to whether the mental life is ever really extinguished in sleep; and we cannot deny the possibility of a continuance of bare organic sentiency, which is lost, on waking, in the richer ideation of the normal consciousness. But, however that may be, introspection gives us no psychological warrant for the assumption of mental process during deep sleep. In the lighter stages of sleep, on the other hand, there is intermittent mentation; we "dream," and the dream consciousness is in large measure accessible to our analysis.

It is probable that dreams, in the great majority of cases, are started by the stimulation of some sense organ and do not take their origin within the brain itself. We may darken our bedroom as we will, but we cannot rule out the "intrinsic gray" or "light dust" of the retina; nor the throbbing and buzzing of the blood circulation in the ear; still less can we eliminate cutaneous and organic stimulations. There is, then, always the possibility of a sense impression finding its way to the brain during sleep. If, now, we keep our eyes closed as we wake from a visual dream, we can often trace the dream pattern in the light dust that is seen upon the field of the closed lids; while, conversely, if we note the pattern of the light dust before we fall asleep and then have ourselves waked, we find that the dream has taken its

form and character from the peripheral excitations. Here is clear evidence that the brain has received its dream cue from the eye. Similar tests have been carried out, with similar though less striking result, upon the other sense organs. As a general rule, then, the dream consciousness seems to be started by some sensory stimulus, though, having once originated, it may continue its course in obedience to the laws of association (q.v.) without any further interference from the outside.

We have supported this conclusion by an appeal to the eye; and the appeal has doubtless appeared quite natural. For dreams are predominantly visual—so strongly visual, indeed, that it is not rare to find them defined, in so many words, as “trains of fantastic images.” There is good reason for this preponderance of visual mind stuff in dreams. 1. Most of us in the waking life are likely to think, imagine, and remember in visual terms; we are “eye-minded.” It is evident that this ingrained habit of mind towards visualization must show itself in dreams. 2. The retina is in a constant state of intrinsic excitation during sleep; the retinal gray and the light dust will, if only the chance be given them, make themselves known in sensation. 3. And the chance must be given them fairly frequently. For sight is the first sense to disappear, as sleep comes on, and the last sense to be regained on waking; so that the eye may be stimulated during sleep with a moderately high degree of intensity, while the sleeper is still not disturbed. Dreams, however, are by no means exclusively visual. Next in order of frequency to dreams of sight stand, perhaps, the dreams whose principal material is organic and temperature sensations. It is curious to note that dreams which are initiated by an organic sensation (a pain, a suffocation, a cramp) are oftentimes translated into terms of vision. A slight intercostal pain may be dreamed of “in kind” as a dagger thrust or the bite of a mad dog; but we shall probably see the dagger and the dog—and in many cases these will be the main objects of the dream, the organic sensation being present merely as a vague discomfort. So the rhythm of breathing may be “seen” as a flight of birds or of angels; and an irritation of the skin may be “seen” as a host of caterpillars or beetles crawling over us. This fact of translation into the language of sight has done much to divert attention from the very common occurrence of organic sensation in the dream life. In the third (or, as some authors would say, in the second) place come dreams of hearing. Conversation is the one form of external stimulus that in everyday life approaches the visual stimuli of our surroundings in regularity and insistency, and fragments of conversation are the most frequent auditory constituents of dreams. Sounds like the humming of bees and the clatter of musketry—the dream interpretations of the intrinsic noises of the ear—follow next in order. Tonal or musical dreams occur, but are rare. Finally, the senses of smell, taste, and cutaneous pressure may and do contribute elements to our dreams; but these elements are extremely liable to visual translation and appear but rarely in pure form.

The dream consciousness is not confined, of course, to sensations, perceptions, and ideas. Every mental formation that is found in the waking life may be represented (or simulated)

in the dreaming state. Thus, the presence of emotion in dreams—surprise and excitement, fear and shame, disappointment and anger, jealousy and perplexity—is a matter of experience. Indeed, the appearance of emotion follows almost as a matter of course from the large part played in dreaming by the organic sensations. (See FEELING; EMOTION.) We have, further, frequent instances of passive memory, i.e., of the recognition of persons or places—recognitions which our waking consciousness not seldom declares to be false recognitions, but which none the less have the true recognitive form and “feel”; of active memory, efforts of recollection; of passive “supplementing in idea of the . . .” (seeming) perception; of active imagination, e.g., the writing of poetry; of resolve and voluntary endeavor; and of active attention. In illustration of the latter we may take the following dream: “I was trying to find the name of a philosophical writer which I knew began with D. I ran through the index of the book I held in my hand, but could not find the name. Then I went to the shelf, took down another book, and ran through its index in the same way, with successful result.” So far, indeed, may this reproduction or simulation go that we sometimes dream that we are dreaming. We say, in ordinary life, “The whole thing seemed like a dream”; and the same experience of dream-likeness reoccurs in the dream consciousness.

We have spoken of the “reproduction or simulation” of mental formations. Our dream poetry, if it be really composed during sleep and not in the half-waking state before complete arousal, is neither rhyme nor reason; the foreign languages that we speak so fluently in dreams are unfamiliar to us in the waking life; our dream resolves are ineffective; our dream recognitions, as we have said, are oftentimes false. These observations have led to the theory that the dream consciousness is composed, in reality, of a mere panorama of images; and that the complex mental formations which seem to occur in dreams are really imaginary. There is, however, no cause for going behind the clear verdict of introspection. The formations occur; but, owing to the extreme limitation and irregular distribution of attention in the dreaming state, they show characteristic differences from the corresponding formations of the waking life.

Here, indeed, is the crucial problem that the dreamer presents to psychology. The arrangement of the dream is fantastic and disorderly; yet, as the dream comes, we accept its events and incidents unquestioned, taking everything for granted. How are we to account for these seemingly opposed facts? 1. The fantastic nature of the dream is explained by the almost unrestricted freedom of association in the dream consciousness. Our waking consciousnesses are regulated by pressure of outside circumstances. In dreaming, as in reverie, there is a practical absence of regulation: an idea of our childhood is as likely to arise as an idea of yesterday; the sequence of ideas may be logical, but may also be determined by the most trivial and irrelevant of connecting links. As a rule, the fundamental things of mind (space perception, personal identity) remain; but even these may undergo dissociative changes. Association is uncontrolled and has free play. 2. On the other hand, dream ideas are intensive and impressive. The sleeping brain is generally inexcitable;

when, however, an excitation makes its way to the cortex, the result is out of all proportion to the intensity of stimulus. It is as if the active part of the brain drained the inactive part of a portion of its stored energy. Moreover, the scenes in a dream come always in single file. Consciousness has nothing of the "thickness" and complexity, the wealth of "fringes" and marginal elements, that it has in waking. The part of the brain stimulated is a strictly local area; the greater part of the cortex is still quiescent. Now, this narrowness of consciousness means that we have no means of comparing the dream event with the data of our past experience; the event does not fall into relations, but stands alone. But an idea which is at once impressive and uncontradicted is, of course, accepted and believed. Hence is it that the dream, despite its absurdity when recounted in the normal environment of the waking life, provokes no scruples or hesitations as we dream it.

Primitive belief and popular superstition have always tended to ascribe importance and meaning to dreams, although, needless to say, without the justification of a systematic gathering of facts. (See DIVINATION.) Of late years, however, the interpretation of dreams has been placed by the work of S. Freud (q.v.) upon a more scientific basis. Freud was led to the study of dreams through their observed relation to certain other abnormal states, notably to hysteria (q.v.). He holds that a single method is adequate to the interpretation of dreams and to the explanation of hysteria: the method of "psychoanalysis," which consists essentially in eliciting and evaluating as many as possible of the ideas associated in the subject's mind to the ideas of the dream or of the hysterical complex. According to Freud, dreams represent the fulfillment of wishes. In the dreams of children the wish is undisguised and the representation is direct. Adults, however, remain even in sleep under the pressure of a social training to repress and censor the expression of certain wishes (especially those of a sexual nature), so that the wish can be represented in the dream only in symbolical or, so to say, allegorical form. The ideas set up by the peripheral excitations mentioned above thus constitute a "patent content" which disguises, though it cannot wholly conceal, the "latent content" of some definite wish fulfillment.

Consult: Wundt, *Human and Animal Psychology* (London, 1896); id., *Grundzüge der physiologischen Psychologie* (Leipzig, 1908-11); Delboeuf, *Questions de philosophie et de science: Le sommeil et les rêves* (Paris, 1885); Maury, *Le sommeil et les rêves* (ib., 1865); Hammond, *Sleep and its Dreaming* (Philadelphia, 1869); Havelock Ellis, *The World of Dreams* (Boston, 1911); S. Freud, *The Interpretation of Dreams* (New York, 1913).

**DREAM LIFE:** A FABLE OF THE SEASONS. A series of sketches by Donald G. Mitchell (1851), a companion volume to his *Reveries of a Bachelor*.

**DREAM OF EU'GENE A'RAM,** THE. A poem by Hood (1829), detailing an imaginary dream narrated by Eugene Aram (q.v.) in making confession to a child of the murder of Clark.

**DREBBEL,** CORNELIS VAN (1572-1634). A Dutch inventor. A peasant by birth, he won the favor of the emperors Rudolph II and Ferdinand II, and of King James I of England. The last 14 years of his life were spent in Lon-

don, where his discoveries in new processes for dyeing wool and silk (afterward used by the founders of the Gobelin manufactures), and his clever inventions, among them a compound microscope and a machine for perpetual motion, gave him the reputation of being a sorcerer. Drebbel has left two treatises, published in Dutch (1608), in Latin (1621), and in French under the title *Deux traités: De la nature des éléments; De la quintessence* (1673).

**DREBER,** drä'bër, HEINRICH, called FRANZ DREBER (1822-75). A German landscape painter, born at Dresden. He studied at the Dresden Academy and under Ludwig Richter and finally—as the stipendiary of the Dresden Academy—at Munich and at Rome, where he joined the group of painters under Reinhart and thereafter resided. His paintings, which were not appreciated during his lifetime, are distinguished by fine and delicate color and poetic conception. He frequently introduced antique figures and folk scenes into his landscapes. Among his best productions are: "Autumn in Sabine Mountains," "Landscapes with Ruins," and about 500 drawings in the National Gallery, Berlin; "Good Samaritan" (1848, Dresden Gallery); "Sappho" (Schack Gallery, Munich); "Evening Voices" and "Landscape of the Campagna with Washerwomen" (Gallery St. Luca, Rome). Although Dreber led a very retired life, he undoubtedly influenced such painters as Böecklin and the younger Preller.

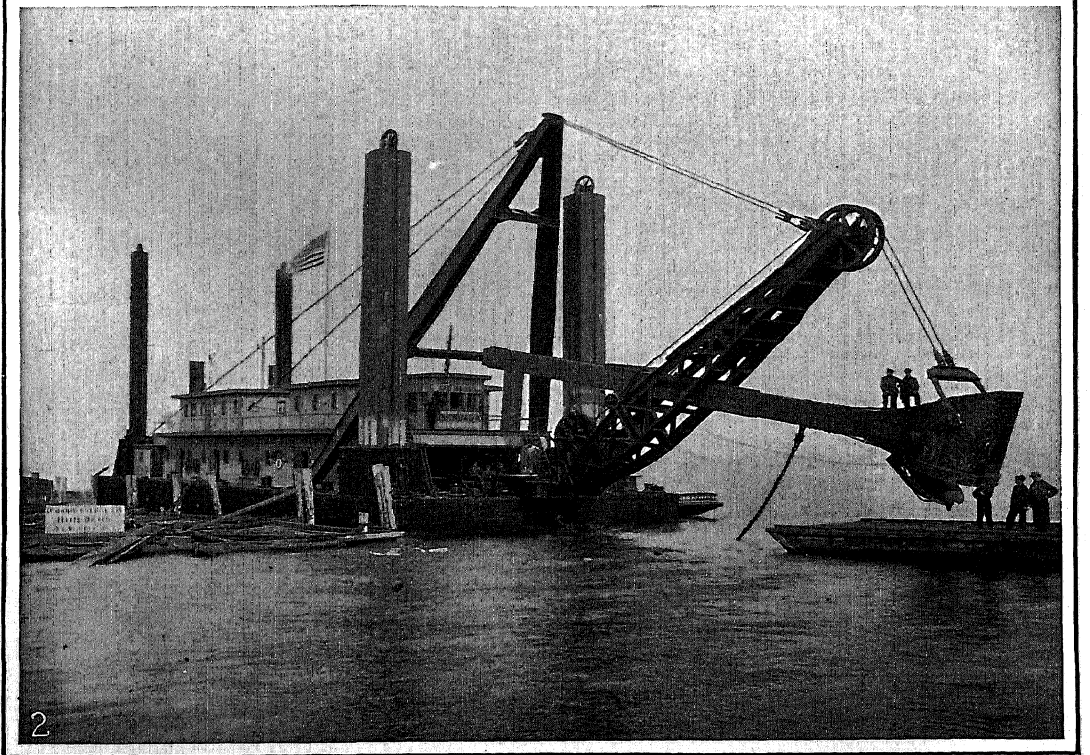
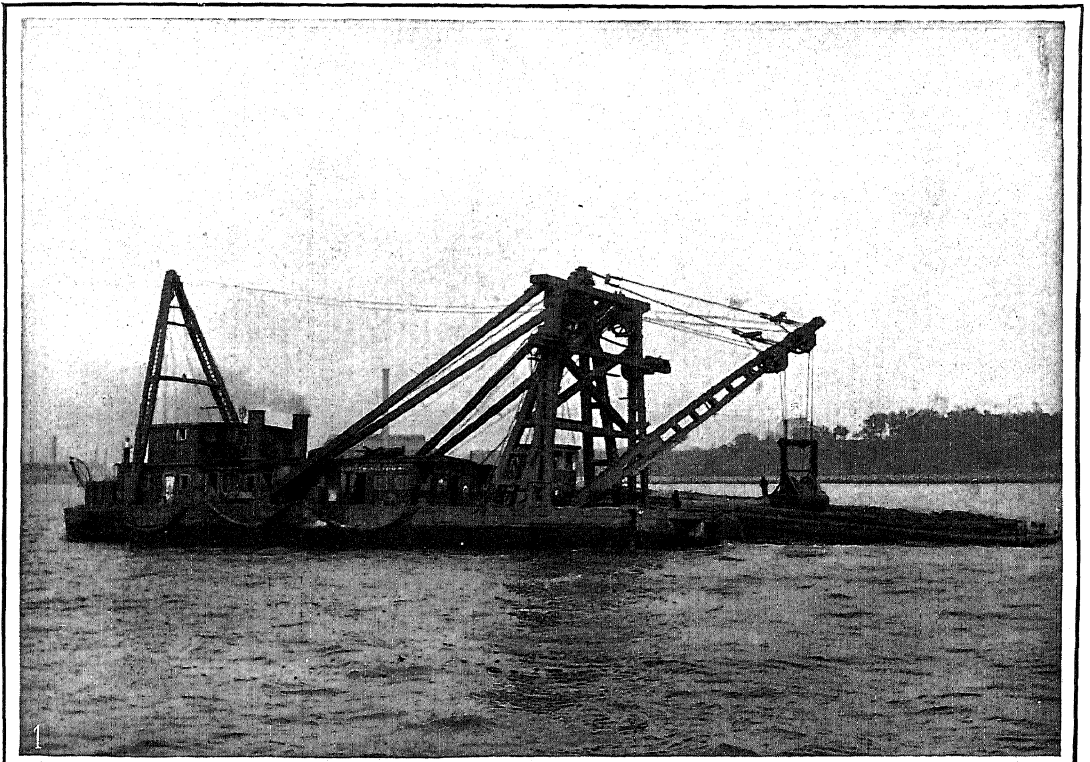
**DRED.** A novel by Harriet Beecher Stowe (1856), exposing the conditions of the Southern slave system. The title character is a fugitive slave. A new edition appeared, 10 years later, entitled *Nina Gordon*.

**DREDGE** (assibilated form of *drag*, AS., Goth. *dragan*, Icel. *draga*, OHG. *tragan*, Ger. *tragen*, Eng. *draw*, *drag*). Any device for removing and bringing up solid substances or material from under water. The simplest form of dredge is that used by oyster fishers, which consists of a strong bag or net whose mouth is kept open by a metal ring, and which is operated by hand by means of a long pole to whose end it is attached. The deep-sea dredge used by scientists for collecting samples of the sea bottom, with its plant and animal life at great depths, is a device similar in its general construction to the oyster dredge, but is, of course, attached to a long wire cable and operated by being dragged along the bottom until filled. (For illustration and description, see DEEP-SEA EXPLORATION.) In engineering a dredge is an excavating device employed in deepening channels and harbors, removing submarine obstructions, such as shoals and bars, raising gold-bearing sand, and for general excavating operations under water. Dredges may be divided into several classes, the principal of which are dipper dredges, ladder (or elevator) dredges, and hydraulic-suction dredges.

The Dipper Dredge is similar in its construction to the ordinary steam shovel, except that the platform carrying the machinery consists of a barge instead of a car. In the ordinary dipper dredging machines a mast or A-frame is mounted on the front end of the barge and serves to support the top end of an inclined boom whose bottom end is pivoted to a suitable casting on the deck of the barge, so that it can swing partially around like the boom of a derrick. Between the two parallel timbers of this boom is inserted a long timber carrying at its outer end a dipper or scoop open at the top and



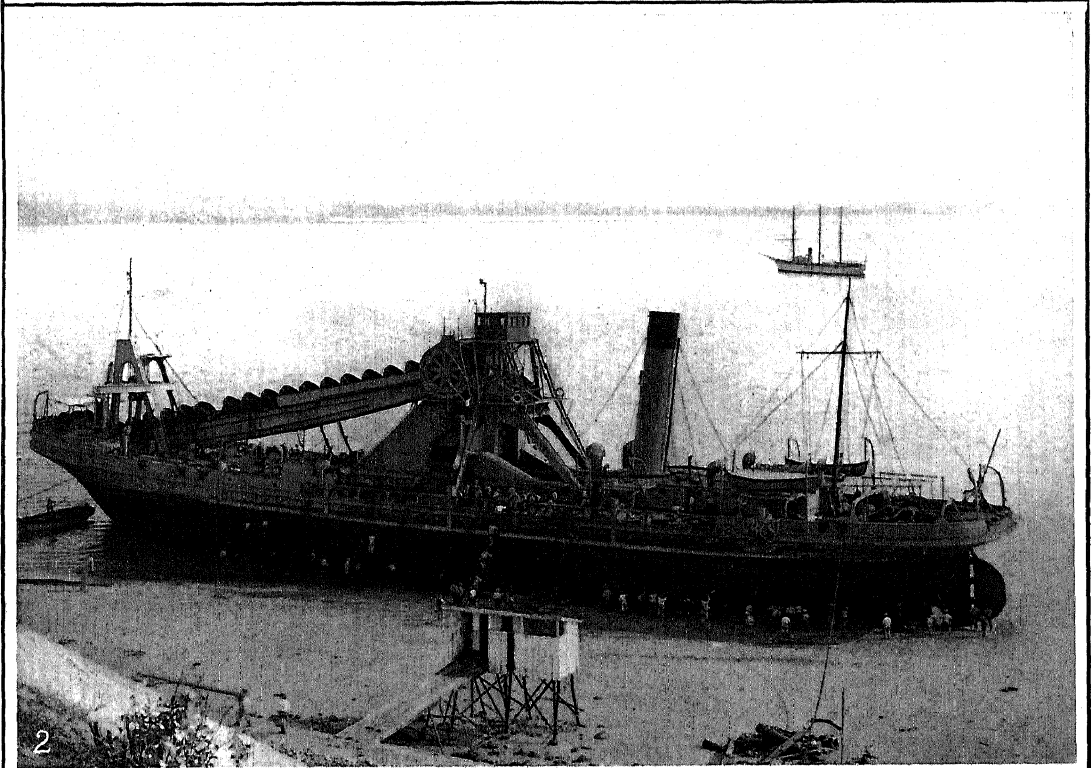
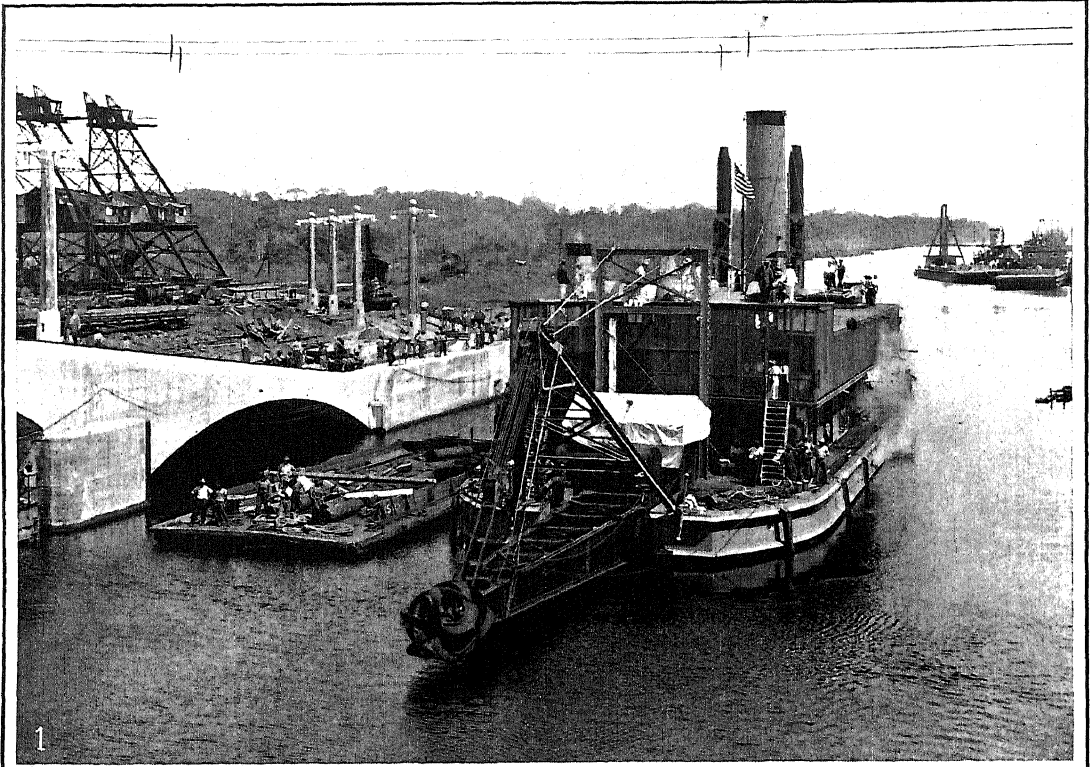
## DREDGES



1. OSGOOD CLAM SHELL DREDGE. This dredge has a bucket of ten cubic yards capacity, and digs to a depth of 80 feet.

2. OSGOOD DIPPER DREDGE. The dipper carries 15 cubic yards of material, and works in depths up to 50 feet.

## DREDGES



1. SUCTION DREDGE USED ON PANAMA CANAL. PASSING THROUGH GATUN LOCK  
2. LADDER DREDGE "COROZAL" USED ON PANAMA CANAL. BEACHED ON PERICO ISLAND FOR REPAIRS



closed by a door at the bottom. By means of suitable mechanism this dipper is thrust down to the bottom and given a scooping motion which fills the dipper; the next operation is to raise the dipper and by swinging the boom to one side bring it over an awaiting barge, when the latch holding the bottom door is unlocked and the contents of the dipper are dumped into the barge. By successive operations these operations the bottom is excavated to such a depth as may be desired. To resist the digging thrust of the dipper, the scow is provided with vertical timbers or spuds, which can be thrust down into the bottom and so prevent the barge from moving. Dipper dredges are more extensively used in America than in European countries. The largest dipper dredges in existence are the two 15-cubic-yard dredges put in service in 1914 on the Panama Canal, to be used there for permanent maintenance of channel depth. The hull of these dredges, which are in duplicate, is of steel, approximately 136 feet long, 44 feet wide, drawing  $15\frac{1}{2}$  feet of water. They are driven by tandem compound steam engines which operate the dredging as well as the propelling machinery. Each dredge has two interchangeable dipper buckets of 15 and 10 cubic yards' capacity respectively, and the dipper handle is an Oregon fir stick 72 feet long. These dredges can operate at a depth of 50 feet of water.

Another form of dredge, known as the **Grapple Dredge**, is constructed much like the dipper dredge in respect to the barge, A-frame, and boom; but instead of a dipper the excavating device proper is a grapple which is so suspended from the end of the boom that it can be lowered to the bottom and raised with its load. One of the most common forms of grapple is the clamshell, which consists of two parts hinged together much like the two parts of a clamshell. The mechanism which raises and lowers the grapple also serves to open and close its jaws. In operation the grapple, with its jaws open, is lowered to the bottom, into which its weight causes it to sink partly; the jaws are then closed and thus grasp a quantity of material, which is raised and discharged into a scow by opening the jaws again. When the material to be excavated is hard, the grapple is provided with teeth, and, when so equipped, it can be used to excavate loose rock. Sometimes the grapple consists of several sectors of a sphere, when it is called an orange-peel bucket. One of the largest grapple dredges ever built was designed for use in constructing the Buffalo (N. Y.) trunkwater. The hull was of wood, 120 feet long, 40 foot beam, and  $12\frac{1}{2}$  feet deep, with a false bow and stern to make it tow more easily, which increased the total length to 160 feet. The A-frame was 50 feet high, and the boom was 65 feet long. The bucket was of the clamshell type, with a capacity of 10 cubic yards and weighing 15 tons. At Buffalo, N. Y., this dredge worked in water 65 feet deep, and loaded 10 or 11 scows of 400 cubic yards' capacity in 10 hours.

The **Ladder, or Elevator, Dredge** consists of a hull for the support of the excavating machinery much like the hull of the dipper or grapple dredge; but the excavating mechanism is essentially different. An elevated structure on the hull carries a long girder whose top end is hinged horizontally to the top of the framework, and whose other end extends down through

a wellhole in the hull to the bottom of the water. There is a sprocket wheel at each end of this girder, over which a flexible endless chain is made to run by power applied to the upper sprocket wheel. At intervals along this chain are attached scoop buckets, which of course travel with the chain. As each bucket reaches the bottom of the girder, which is in contact with the bottom of the channel being excavated, it scoops up a portion of the material and carries it to the top of the girder, where the load is discharged as the bucket passes over the upper sprocket wheel. The buckets discharge into chutes leading to scows moored alongside or to a conveyor leading to the dredge itself. Sometimes the girder, with its chain of buckets, is arranged to pass over one or both sides of the dredge hull instead of through an inside well. The Panama Canal dredge *Corozal* is the largest machine of this type. It is housed in a hull 268 feet long, 45-foot beam, and drawing 17 feet under maximum load. There are 40 54-cubic-foot and, for alternate use, 40 34-cubic-foot buckets mounted on the endless chain, which runs on a boom capable of digging at a depth of 50 feet. The dredge has a capacity of 1200 cubic yards per hour in sand or mud and somewhat over half that amount in hard clay and bowlders. The ladder, or elevator, dredge is used extensively in removing gold-bearing sand and will be found discussed and illustrated under GOLD MINING.

**Suction Dredges** are extensively used where the material to be excavated is mud, sand, or other soft matter which can be mixed with water and pumped through pipes. The excavating machinery consists of a suction pipe which can be lowered through a well or over the side or end of the hull, a centrifugal pump for sucking or drawing a stream of water through the suction pipe, and a discharge pipe through which the pump discharges the water thus sucked in. In operation the end of the suction pipe is lowered to the soft bottom and partly buries its end in the material. The pump is then started and sucks a stream of water and mud through the suction pipe and discharges it into the discharge pipe. In most dredges of this type the end of the suction pipe is provided with revolving cutters or with water jets to loosen the material, so that it will be more easily drawn into the suction pipe. The discharge pipe may lead to hoppers in the dredge, or it may be extended to the shore and discharged at some point where land is to be filled in or where the waste material will do no injury. The two suction dredges built during 1900 for removing the 40,000,000 cubic yards of sand and mud in the East Channel improvement of New York harbor are among the most complete suction dredges of the hopper type ever built. These dredges have hulls 300 feet long, with a beam of  $52\frac{1}{2}$  feet and a depth of 25 feet. The hoppers on each dredge have a capacity of 2800 cubic yards and occupy a space of 125 feet amidships on each side of the hull. Between the two rows of hoppers is the well for the suction pipe. Water jets are used to loosen the material. The centrifugal pump has a capacity of 75,000 gallons of water per minute. The dredge is provided with its own propelling machinery.

The four types of dredges which have been briefly described are often modified in their construction and arrangement for special uses, and the features of one type are often combined

with the features of another type to form a combination machine. The best descriptions of dredges are to be found in the various engineering society periodicals and the engineering papers of Europe and America. Consult C. Prelini, *Dredges and Dredging* (New York, 1911).

**DREDGING, DEEP-SEA.** See DEEP-SEA EXPLORATION.

**DRED SCOTT CASE.** One of the most important cases ever decided by the Supreme Court of the United States. It came up from the lower court on an agreed statement of fact. One Dred Scott, a slave owned by Dr. Emerson, of the regular army, a resident of Missouri, had in 1834 been taken by his owner into Illinois, a Commonwealth where slavery was prohibited, and had later (1836) been taken into what is now Minnesota—a part of the Louisiana Purchase, in which slavery was expressly prohibited by the Missouri Compromise of 1820 (q.v.). While on free territory (1836) Scott had been allowed to marry, his wife being a slave, also owned by Dr. Emerson; and later—in 1838—with his wife and a child born to them on free soil, he was taken back into Missouri. In 1848 he resolved to sue for his freedom, and in this purpose he was gratuitously aided by prominent lawyers of free-soil beliefs. The chief ground of his contention was that, though his residence in territory where slavery was prohibited, he had lost his status as a slave and acquired that of a freeman. The Supreme Court of Missouri, however, held (1852) that, upon being brought back into territory where slavery was legal, the status of slavery reattached to him and that he had no standing before the court. As involving a question under the Federal laws and Constitution, the case was brought in 1854 before the Federal Circuit Court, which held that Scott was a citizen of Missouri and could be a party in a suit before a Federal court, but decided the case against him. The case was then taken on appeal to the Supreme Court of the United States, where the chief legal question was as to the correctness of the lower court's decision that the Federal court might take jurisdiction of a case brought by a person of such a status as was that of Scott. The case was argued at length in 1855 and 1856, and the decision was not finally handed down until March, 1857. The Supreme Court held (Curtis and McLean dissenting) that the Circuit Court had erred in entertaining the suit, because Scott was not a citizen and therefore was not entitled to any standing in the courts; that, at the time of the formation of the Constitution, negroes descended from negro slaves were not, and could not be, citizens in any of the States; and that there was no power in the existing form of government to make citizens of such persons. This point was so decided by a majority of the court. In the course of his decision Judge Taney used the following language: "It is difficult, at this day, to realize the state of public opinion in relation to that unfortunate race which prevailed in the civilized and enlightened portions of the world at the time of the Declaration of Independence and when the Constitution was framed and adopted. But the public history of every European nation displays it in a manner too plain to be mistaken. They had for more than a century before been regarded as beings of an inferior order and altogether unfit to associate with the white race, either in social

or political relations; and so far inferior that they had no rights which the white man was bound to respect, and that the negro might justly and lawfully be reduced to slavery for his benefit. He was bought and sold, and treated as an ordinary article of merchandise and traffic, whenever a profit could be made by it. The opinion was at that time fixed and universal in the civilized portion of the white race." The single sentence, "no rights which the white man was bound to respect," has often been quoted apart from its connection, though it was designed merely as a statement of opinions prevalent when the Constitution was adopted. A dissenting opinion, however, was read by Mr. Justice Curtis, showing the error of Chief Justice Taney's historical argument against the possibility of such persons attaining citizenship, and forcibly contending that, as nothing had been shown except that Scott was a negro and was descended from negroes who had been slaves, his claim to citizenship had not been seriously controverted. Not content with deciding the only question of law involved, the Chief Justice, in an *obiter dictum* which has become historic, went further and undertook the discussion of matters generally considered foreign to the case and not necessarily involved in the decision of the lower court. Taking up the subject, at that time of vital importance, of the power of Congress over the Territories, the majority of the court held that the Missouri Compromise was unconstitutional; that the power of Congress to govern the Territories was subordinate to its obligation to protect private rights in property; that slaves were property and, as such, were protected by the constitutional guarantees; that Congress had no power to prohibit a citizen of any State from carrying into any Territory slaves or any other property; and that Congress had no power to impair the constitutional protection of such property while thus held in a Territory. By this dictum (from which Curtis and McLean wholly, and Catron partially, dissented) one of the extreme doctrines of the proslavery party was affirmed as correct, and even the dogma of "popular sovereignty" was discountenanced. The decision, coming immediately after the inauguration of Buchanan, aroused intense feeling, made still more clear the issues which were to be decided in the impending crisis, and impressed upon the North the seriousness of the task of the party of freedom, when opposed both by the executive and by the judicial departments of the national government. The full text of the decision is in vol. xix of Howard's *United States Reports*. Consult also: Tyler, *Life of R. B. Taney* (Baltimore, revised ed., 1872); G. T. Curtis, *Memoirs and Writings of Benjamin R. Curtis* (Boston, 1880); Corwin, "The Dred Scott Decision in the Light of Contemporary Legal Doctrines," in *American Historical Review*, vol. xvii (1911).

**DREIBUND**, drī'būnt. See TRIPLE ALLIANCE.

**DREISER**, drī'sēr, THEODORE (1871– ). An American editor and author, born in Terre Haute, Ind., and educated at Indiana University. Taking up newspaper work on the *Chicago Daily Globe* (1892), he was later dramatic editor and traveling correspondent of the *St. Louis Globe-Democrat* (1892–93) and traveling correspondent of the *St. Louis Republic* (1893–94). Subsequently he did special work for a number of magazines, and was editor of *Smith's Magazine*

(1905-06), managing editor of the *Broadway Magazine* (1906-07), and editor in chief of the Butterick publications (1907-10). Besides his special magazine articles, he is author of *Sister Carrie* (1900; 3d ed., 1912); *Jennie Gerhardt* (1911); *The Financier* (1912); *A Traveler at Forty* (1913); *The Titan* (1914).

**DREISSENSIA** (Neo-Lat., from *Dreyssen*, a Belgian naturalist). A genus of small lamellibranchiate mollusks, allied to the mussels. *Dreissensia polymorpha* is interesting because, having been accidentally introduced from its native home about the Caspian Sea into western Europe, it has fully established itself and has invaded water pipes in many districts of Great Britain, becoming a nuisance. It is capable of living a long time out of water with its valves closed and may have come to Great Britain on timber imported from the Continent.

**DRELINCOURT**, drā-lān'kōōr', CHARLES (1595-1669). A French Protestant theologian, born in Sedan. In 1620 he went to Paris and was made minister of the church at Charenton. Among the best known of his writings, many of which were popular in English translations, are: *De la persévérance des saints* (1625); *Du jubilé des églises réformées avec le jubilé de l'église romaine* (1627); *Consolations de l'âme fidèle contre les frayeurs de la mort* (1651), to promote the sale of which Defoe wrote the *Apparition of Mrs. Veal*. He wrote a catechism (1642) and many anti-Catholic pamphlets.

**DREN'TELN**, ALEXANDER ROMANOVITCH (1820-88). A Russian soldier, born in Kiev. He entered the army in 1838, in 1867 became adjutant general, and in 1877, at the outbreak of the Russo-Turkish War, was appointed to the command of the reserves in Rumania. From 1878 to 1880 he was director of the third section of the Imperial Chancellery, in which capacity he controlled that portion of the Russian police which had to do with political offenses. An attempt upon his life was made by a Nihilist in 1879. In 1880 he was appointed a member of the Imperial Council and Governor-General of Odessa, in the latter capacity being transferred to Kiev a year later.

**DREP'ANUM**. See TRAPANI.

**DRESDEN**, drēz'den. A town of Kent Co., Ontario, Canada, at the head of navigation on the Sydenham River (Map: Ontario, B 8) and on the Erie and Huron division of the Père Marquette Railroad. It has flour mills, elevators, grist mill, foundry, builders' factory, planing mill, cannery, and creamery. It is situated in a fertile farming district producing, in addition to the staple agricultural products, sugar beets and tobacco. Pop. 1601. 1613; 1911, 1551.

**DRESDEN**, drēz'den, Ger. pron. drās'den. A city of Germany, capital of the Kingdom of Saxony, situated on both banks of the Elbe, in lat. 51° 3' 3" N. and long. 13° 44' E., by rail 71 miles east-southeast of Leipzig and 111 miles south of Berlin (Map: German Empire, E 3). The Elbe separates the Altstadt and Friedrichstadt and their eight suburbs on the left bank from the Neustadt and Antonstadt with their suburbs on the right bank. The river is crossed by five bridges. The Augustus Bridge, built in the fourteenth century, was replaced in 1727-31 by a structure 1420 feet long, with 16 arches; this was demolished and was replaced in 1908-09 by a wider bridge, known as the Frederick Augustus Bridge. In the Altstadt the streets are mostly narrow; in the Neustadt they are more spacious.

Dresden has numerous squares and parks, both in the old and the new parts. Its largest park, the Grosse Garten, is situated southeast of the Altstadt and contains, besides numerous statues, a museum of antiquities and a zoological and a botanical garden. It was laid out in 1870 and contains 383 acres. The most noteworthy of the squares of the Altstadt are the Altmarkt, the Neumarkt with its Luther Memorial, the Theater-Platz with the statue of King John by Schilling, and the Schloss-Platz. Across the Elbe the principal squares are the Albert, the Kaiser Wilhelm, and the Alaun. Along the left bank of the Elbe lies the Brühl Terrace, the finest promenade of the city. It is about half a mile long, with a beautiful staircase decorated with gilded statuary. The churches of Dresden are numerous but none of them is of great interest. The church of Our Lady in the Neumarkt, dating from the beginning of the eighteenth century, has a lofty lantern (311 feet) and contains a fine baroque altar. Near the Augustus Bridge is the Roman Catholic Court Church (1739-51), in the baroque style. It is surmounted by a tower 280 feet high, and its façade is adorned with 59 statues of saints by Mattioli. The Protestant Sophienkirche, with twin spires, was built in 1351-57, and was restored in 1864-68.

Among the secular buildings the most prominent is the royal palace, built in 1530-35 by Duke George and considerably enlarged and adorned by Augustus the Strong; it was restored and partly rebuilt in 1890-1902. It is partly built in the style of the seventeenth century and has a tower 331 feet high. Its great court contains several noteworthy winding staircase towers. The banquet and throne halls are decorated with mural frescoes by Bendemann. The Zwinger (begun in 1711) is the vestibule of an extensive and magnificent palace begun during the reign of Augustus the Strong by the architect Johann Poppelmann, and never completed. The Zwinger comprises seven pavilions connected by a gallery, with an oblong court in the centre. It is built in the baroque and rococo styles. Its northeast wing forms the Museum, a very fine building in the Renaissance (1846-55). It is profusely decorated with sculptures, including statues of Michelangelo, Giotto, Holbein, Dürer, and Goethe. Among other public buildings are the Prinzen-Palais, erected in 1715, the Brühl Palace, and the Court Theatre, a beautiful Renaissance edifice completed in 1878. The new post office, the Academy of Medicine and Surgery, the Rathaus, and the courthouses are also noteworthy. Among the public buildings of the Neustadt, the most interesting is the Japanese Palace, dating from 1715, and now containing the Royal Library.

Among the educational institutions of Dresden are the Royal Technical High School, with several faculties and over 1500 students in 1913, a number of gymnasia and realschulen, and several art and denominational schools. The Royal Music School is one of the most celebrated institutions of its kind. Dresden has three municipal theatres, of which the famous Court Theatre is devoted to opera and important dramas and is one of the leading theatres in the world. In art collections and libraries Dresden ranks high. As early as the sixteenth century the Saxon princes began to accumulate works of art and laid the foundations of the splendid galleries and museums for which Dresden is

famous. The Royal Library was founded by the Elector Augustus in the sixteenth century. It contains about 570,000 volumes, a large number of manuscripts and maps, and a collection of portraits. The Museum Johanneum possesses a rare collection of Chinese, Japanese, Indian, Sèvres, and Dresden porcelain, numbering about 15,000 pieces.

The Dresden Picture Gallery, for which the city is best known, is located in the Museum of the Zwinger, and contains upward of 2500 canvases. The collection is especially rich in Italian and Dutch works. Among the numerous Italian masters represented are, first of all, Raphael with his most celebrated picture, "The Sistine Madonna"; Andrea del Sarto; Correggio ("Holy Night"); Titian ("The Tribute Money"); Palma Vecchio ("Venus and the Graces"); Paolo Veronese, Tintoretto, Caravaggio ("The Card Sharper"), and Ribera are also to be seen here to advantage. Of the Spanish school Velasquez and Murillo are represented by one fine picture each. Masterpieces of the Flemish school are especially numerous, including the "Boar Hunt" and other famous canvases by Rubens, admirable portraits by Van Dyck, and a number of pictures by Jordaens and Teniers the Elder. Among the Dutch masters are Rembrandt ("Portrait of Himself and his Wife sitting on his Knee" and "Manoah's Sacrifice"), Frans Hals, G. Dou, Adriaen van Ostade, Ruysdael, Paul Potter, Van der Meer, Terburg, and Metz. The French schools of the seventeenth and eighteenth centuries are represented by landscapes of Claude Lorrain and examples of Poussin and Watteau. Of the German school, Holbein and Dürer are the conspicuous figures. There are masterpieces by modern painters, including Munkácsy, Fritz von Uhde, Böcklin, and Delaroche. Besides the picture gallery the museum contains over 350,000 woodcuts and copper engravings. Among other collections in Dresden may be mentioned that of precious stones, jewels, etc., in the famous Green Vault of the royal palace. There is also the collection of ancient and modern arms, implements, and costumes in the Museum Johanneum, one of the completest historical museums in Germany.

Dresden is administered by a chief burgo-master, 2 burgomasters, 33 aldermen, 17 assessors and referendaries, and a council of 72 members. The municipality owns and manages its water works, gas plant, and an electric plant, as well as the abattoirs. The cleaning of the streets is done entirely by the city, which is one of the cleanest in Germany. The Dresden Bank is a very large and important institution.

The manufacturing industries and commerce of the city are of considerable importance. Noteworthy products are machinery, pianos, gold and silver articles, paper, and porcelain. The publication of books and the production of art objects of various kinds are very extensive. Dresden is the seat of consular representatives from numerous countries, including the United States. The commerce is considerable, mostly by rail. The completion of its fine harbor will undoubtedly give a stimulus to water transportation. In 1834 the population was 73,614; in 1852, 104,500; in 1880, 220,818; in 1890, after the annexation of Strehlen and Striesen, it had increased to 289,841. In 1895, after further annexation of suburbs, the population was 354,285; in 1900 the total reached 396,146, and, in 1910, 548,308. Two-thirds of the inhabitants

live on the left bank (Altstadt) of the Elbe. The great majority are Lutherans, though the royal house is Roman Catholic. Dresden is the royal residence, the seat of government for Saxony, and the headquarters of the Twelfth Army Corps. The climate of Dresden is marked by frequent and sudden changes. The suburbs along the picturesque Elbe as far as Pillnitz are very attractive, with their castles, beautiful villas, and interesting associations in connection with the lives of famous Germans.

**History.** Dresden is of Slavic origin. It was first called a city in 1216. At the end of the thirteenth century it became the residence of the margraves of Meissen, but did not begin to grow before the end of the fifteenth century, when it passed to the Albertine line. Its fortifications were begun in the sixteenth century. Many considerable and attractive improvements were made by John George II, including the Grosse Garten, and under the rule of Augustus II and III (1694-1763) Dresden became one of the finest cities of Europe. The old part was ruined by the fire of 1685 and was rebuilt as the Neustadt by Augustus I in 1732. The Seven Years' War put an end to the growth of the city, and the bombardment of 1760 by the Prussians destroyed many of its buildings. During the Napoleonic wars Dresden suffered considerably. In 1813 it was converted by Napoleon into a great arsenal, and here he won his last victory on German soil. (See DRESDEN, BATTLE OF.) In 1817 the fortifications were demolished to give way to promenades. With the opening of the Elbe to navigation, and the construction of railways, the city began to grow in economic importance, and its progress was only slightly retarded by the political upheavals of 1848-49. In 1866 Dresden was taken by the Prussians, who held it until the end of 1867. Consult: Lindau, *Geschichte der königlichen Haupt- und Residenzstadt Dresden* (Dresden, 1884-85); Gsell-Fels, *Dresden und Umgebung* (Munich, 1896); Sendig, *Dresden, eine Fremdenstadt* (Dresden, 1898); Schumann, *Führer durch die Architektur Dresdens* (ib., 1899); Gurlitt, *Die Kunstdenkmäler Dresdens* (ib., 1900); *Statistisches Jahrbuch für die Stadt Dresden* (ib., 1899 et seq.).

**DRESDEN, BATTLE OF.** A battle fought, Aug. 26-27, 1813, between the French, under Napoleon, and an allied army of Austrians, Russians, and Prussians, under the command of Prince Schwarzenberg. On August 21 the allies had begun their march from Bohemia, and on the 25th they appeared, 150,000 strong, before Dresden, which was defended by Saint-Cyr, with 20,000 French troops. Napoleon had left the city on the 17th to go to the support of Ney, who was operating against the Army of Silesia under Blücher. On receiving news that the allies were preparing to attack Dresden, he immediately returned by forced marches, but on the 25th he was still 15 miles from the capital, and had it not been for a fatal delay on the part of Prince Schwarzenberg, the city might have been taken before the Emperor's arrival. As it was, the assault was not delivered until seven o'clock on the morning of the 26th. The French were intrenched in the Altstadt, on the southern bank of the Elbe, and had command of the bridge across the river. The line of the allies extended in a huge crescent to the east and south of the city, with the Russians on the right wing, the Prussians in

the centre, and the Austrians on the left. In the first attack the allies were successful along the entire line, in spite of the desperate resistance of the French. The Russians stormed one of the fortifications to the east of the city, the Prussians gained possession of the greater part of the Royal Park to the south, while the Austrians carried the suburbs to the southwest. It seemed, early in the morning of the 26th, that Saint-Cyr would be compelled to capitulate. At noon, however, the Russian and Prussian advance was checked by order of the commander in chief, in expectation, probably, of a reinforcement of 50,000 men under Klenau, and the attack was not resumed until four o'clock in the afternoon. About noon French troops began pouring into the city from across the Elbe. Napoleon had arrived; and when the allies resumed the assault, the French had 100,000 men to oppose them. The effect was felt at once. The Russians on the right were driven from their positions, and in the centre the Prussians lost part of the ground they had gained in the morning. The Austrians on the left were also checked. Night and rain brought a stop to the fighting. Napoleon meanwhile had determined to deliver an attack on both wings of the allied army simultaneously and then, by converging on the Prussian position, to crush the enemy's centre. The battle was resumed at six o'clock in the morning. On the right wing of the allies the divisions of Ney and Mortier drove the Russians from the heights to the south of the city. The victory, however, was gained on the French right. There, while Victor was assaulting the Austrians, Murat, with 20,000 cavalry, swept around their left flank and took them in the rear, crushing out all resistance and taking more than 13,000 prisoners. The Prussians in the centre were prevented from going to the support of either wing by a furious cannonade and repeated charges of the Old and the New Guard. At four o'clock in the afternoon the allies began the retreat into Bohemia. The loss of the allies in killed and wounded was about 15,000 or 18,000, and more than 20,000 prisoners fell into the hands of the French. Their own losses were about 10,000 in killed and wounded.

**DRESS** (Lat. *directus*, straight, through, Fr. *dresser*, to set up or straighten). The clothes worn by men, women, and children. As considered from the point of view of style, the subject is treated under **COSTUME** and **FASHION**. It is almost a truism to say that the progress of civilization is marked by the progress of clothes, and that, other things being equal, the best-clothed nations are the nations most highly developed. When the energy of the human body is wasted in combat or amid cold or heat or moisture or dirt, less is left for the accomplishment of useful tasks, of creative mental and physical labor. From the economical point of view, as well as from the point of view of comfort, clothing and cleanliness pay.

Modern dress is determined mainly by four considerations—climate, hygiene, decency, and use—although fashion or convention may override all of these. Cold in the winter, heat, dust, and insects in the summer, are important factors in regulating the amount and kind of dress worn. The use of washable underclothing and the frequent bathing of the body are characteristic of advanced civilization which demands increasing attention to the hygiene of clothing,

its character and texture, as well as to the hygiene of the body. The Greeks and Romans had already developed the use of an inner garment (Greek *χιτών*, Roman *tunica*) in addition to the outer garment (Greek *ιμάριον*, Roman *toga*), while about the time of Augustus the Romans had also begun to wear an undershirt (*tunica interior* or *intima*). Sense of decency or conventional modesty is an important consideration in the determinations of dress at any period, but it is impossible to decide to what extent one is controlled by the other. Finally, the shape or cut of clothes may be regulated by their value in use. Thus, the women who work in the field, as in Switzerland, or in the mines, as in Belgium, wear trousers instead of the conventional skirts, which not only hamper the movement of the body, but may also be unhygienic. So too the modern development of gymnastic and athletic sports has led to specialized forms of dress both for men and women. See **TEXTILES**. For bibliography, see **COSTUME**; **FASHION**.

**DRESSER**, HENRY EELES (1838– ). An English ornithologist. He was born at Thirsk, Yorkshire, and, after studying in England, Germany, and Sweden, devoted himself to commercial pursuits, giving considerable time, however, to investigations in European ornithology, on which subject he is considered an authority. He wrote: *A History of the Birds of Europe* (8 vols., with colored plates, 1871–81); *A Monograph of the Meropidae, or Family of the Bee Eaters* (1884–86); *A Monograph of the Coraciidae, or the Family of the Rollers* (1893); *Manual of Palearctic Birds* (1902–03).

**DRESSINGS**. In architecture, a term loosely used to signify the more finely finished parts of the exterior as distinguished from the plainer work of the walls; especially the decorative parts around windows and doors, and bands, moldings, copings, etc.

**DRESS REFORM**. Dress reform, in the narrow sense in which it is customary to use the term, signifies a more or less definite and concerted movement against unhygienic clothing for women which began about the middle of the nineteenth century.

In the United States the earliest crusader against long skirts, high heels, a multiplicity of bands, restricted breathing capacity, and other unhygienic forms of clothing, was Amelia Bloomer. In 1851 Mrs. Bloomer, as editor of the *Lily*, a paper advocating equal-suffrage rights for men and women, gave some space to the discussion of a comfortable and sensible dress for women. In her case this dress took the form of full Syrian or Turkish trousers extending to the ankle in summer, and in winter tucked into high boot tops, worn with a scant skirt coming just below the knees. The credit of originating this costume, although it has always been known by her name, Mrs. Bloomer in her writings expressly gives to Mrs. Elizabeth Smith Miller, from whom she says she copied it, as did Mrs. Elizabeth Cady Stanton. Mrs. Lucy Stone (Blackwell), another of the pioneer American women suffragists, also adopted it for a time. But all of these ladies eventually returned to a dress more closely resembling the generally accepted one of their day.

As early as 1857 a National Dress Association was engaged in trying to spread hygienic ideals of dress among the women of the United States,

but their efforts seem to have been abortive at that time.

In England the Rational Dress Movement, as it was called, began in the seventies. It grew about equally from two roots—the Pre-Raphaelite æstheticism, which flourished at that time, and a zeal for woven woolen clothing, which, sweeping over Germany, spread to England. The Pre-Raphaelites advocated, as an artistic need, a return to the simple lines and the color combinations which they declared had not been found in English costumes since the middle of the fourteenth century. The “antique” waist—untrammelled and large—was taught by them to be more beautiful as well as more healthful than the tapering, hourglass waist. In spite of the clever ridicule spent upon them as apostles of a “greenery gallery” cult, they really accomplished something for the cause of dress reform. The “woolen” crusade of the same period, basing its arguments upon pathological rather than æsthetic grounds, also bore excellent fruit in warmer, more closely fitting, less cumbersome underclothing.

In 1874 a second National Dress Association was formed in Boston. Lectures were given by prominent physicians in which were attacked the chief evils of women's dress—viz., the corset, distorting the internal organs and interfering with breathing; the carrying of a weight of cloth upon the hips, resulting in further abdominal displacements; the long skirt, impeding locomotion and harboring disease germs; the capricious and uneven nature of the protection against cold; the high heels and pointed toes of shoes, causing unhealthiness of the entire body as well as local troubles; and the face veil, that prolific source of ocular troubles.

Systems of rational dress have been devised as a result of this movement. In the United States Mrs. Anna Jenness-Miller became the most widely known exponent of a system combining a due regard for hygiene with some regard for beauty and for ancient prejudices. In England Lady Harberton, president of the Rational Dress Association, became the recognized leader of the movement. Her system differs greatly from that of Mrs. Jenness-Miller, for she advocates a modification of the Turkish trouser costume, clothing her servants in it. In England there are also a National Health Dress Association and a National Funeral and Mourning Reform Association.

At the World's Fair in Chicago in 1892 a Dress Reform Congress was held, and new life was infused into the cause. So many cities organized Rainy-Day Clubs, with members pledged to wear short skirts in sloppy weather, that the rainy-day skirt is now as familiar an object of the fashion plate and of commerce as the pelisse and the dolman once were.

In Germany the first definite effort of modern times against unhygienic clothing for women was made under the auspices of the Crown Princess of Saxony in 1873. At her suggestion Dr. Max V. Pettenkofer, professor of hygiene at the University of Munich, delivered a course of lectures on the subject which aroused some public interest. Almost at the same time Dr. Jaeger, of Stuttgart, inaugurated his crusade against all forms of clothing not woolen. The chief articles in his creed were the necessity for warmth about the middle of the body and the prevention of accumulation of fat and water.

Wool, on account of its heating and absorbing qualities, he held to conduce towards this end.

There has been no widespread movement elsewhere on the Continent in favor of a more rational style of dress for women. There has been practically no legislation anywhere on the subject. A minister of education in Russia, in the last decade of the nineteenth century, attempted to prohibit the wearing of corsets by girl students under a certain age, but was unable to accomplish this reform. See DRESS; COSTUME; FASHION.

The general participation of women in outdoor sports has probably done as much for the cause of dress reform as the conventions and agitation of the past—unless, indeed, all this has made the participation possible. Athletics, however, demanding short skirts, ample breathing space, light-weight but warm clothing, and the possibility of unhampered movements, and making conventional the attire which permits all these, is undoubtedly the strongest ally which dress reform has ever had. Consult: Woolson, *Dress Reform* (Boston, 1874); Bloomer, *The Life and Writings of Amelia Bloomer* (ib., 1895); Godwin, *Dress and its Relation to Health and Climate* (London, 1884); Haweis, *The Art of Dress* (ib., 1881).

**DRESS SHIP.** A nautical term for ornamenting a ship with flags. It is usually done on national holidays, on the occasion of some particular fête or celebration, or in honor of some distinguished visitor, or as a mark of courtesy towards foreign nations when their own ships are dressed. In its simplest form it consists in having the national colors at the mastheads and at the peak (head of the spanker gaff) or color staff, and hoisting the jack at its own staff in the bow. To full-dress ships additional flags are hoisted. These consist of the flags of the signal code. (See SIGNALS, MARINE.) In the case of naval vessels the flags of the navy signal code and of the international signal code are both used. The ordinary plan is to have these flags arranged in a line from the water forward (a few are on a weighted line hanging underneath the flying jib boom) up along the line of the stays, then between the mastheads to the peak of the gaff, and thence over the stern. This is called dressing ship *rainbow fashion*. In addition the national colors are hoisted at the mastheads and aft, and jack forward, as before. Should the dressing be a courtesy to a foreign government, the colors of that nation are hoisted at the mainmast head. Vessels having but one mast usually bring the flags past the smoke pipes aft to the stern in two lines. No national colors are used in dressing ship except at the mainmast head, as already mentioned, as it would be considered discourteous to exhibit one and not another, or to place one in an inferior position to that of another, and all could not be given positions of honor. Merchant ships frequently, and men-of-war occasionally, dress ship by arranging the lines of flags on each mast from the masthead to the water, following the extremities of the yardarms.

**DREUX**, drê. The capital of an arrondissement in the Department of Eure-et-Loir, France, on the Blaise, 51 miles west of Paris (Map: France, N., G 4). The principal buildings are the church of Saint-Pierre, a fine unfinished Gothic structure of the period from the thirteenth to the fifteenth century; a splendid town



hall, dating from the sixteenth century, containing a notable organ case; the Doric mortuary Chapelle Saint-Louis of the Orléans family, with numerous pieces of sculpture, and beautiful stained-glass windows; and the ruins of the ancient castle of the counts de Dreux. Dreux has extensive foundries and nurseries, with manufactures of coarse cloth, serge, leather, and glass, with a trade in sheep and cattle. Pop., 1901, 9697; 1911, 10,692. Dreux was an important town of the ancient Gauls and was called Durocassis or Drocæ by the Romans. It gave its name to a famous line of counts which became extinct in 1378. It was the scene, on Dec. 19, 1562, of the first great battle in the wars of France, when the Catholics under the Duc de Guise defeated the Huguenots and took their leader, the Prince of Condé, prisoner. In 1870 it was taken by the Germans.

**DREVET**, dré-vá'. A family of French engravers.—**PIERRE** (1663-1738) was born at Loire, near Lyons, studied at Lyons, and then went to Paris, where he was a pupil of Gerard Audran and Hyacinthe Rigaud. In 1696 he was made engraver to the King, and in 1707 became an Academician. Drevet's best work was done after portraits by Rigaud, and his masterpiece is "Louis XIV standing before the Throne" (1712). In his delicate gradation of tones and management of detail he is hardly surpassed by any engraver of his day. He left 125 plates. Among his pupils was his son **PIERRE IMBERT** (1697-1739), who, when 26 years old, engraved the portrait of Bossuet after Rigaud, which in every sense is a masterpiece. He surpassed his father in grace and precision and in his use of light and shade as an interpretation of color, but they did many plates together, and it is often difficult to isolate the work of one. Pierre Imbert was also engraver to the King. Among his plates are some beautiful specimens after Coppel and Louis de Boullogne and fine portraits of Adrienne Lecouvreur and Samuel Bernard.—**CLAUDE** (1697-1781) was a nephew and pupil of Pierre. He was not the equal of his uncle or his cousin and has left only five plates representing religious subjects and nine portraits after Rigaud. Consult *F. Drevet* (Paris, 1876).

**DREW**, DANIEL (1797-1879). An American capitalist. He was born in Carmel, N. Y., where he began life as a drover and dealer in cattle. In 1834 he bought an interest in a steamboat which was run between New York and Peekskill, in competition with the line established by Cornelius Vanderbilt. The service was improved by the addition of new boats, and in 1840 Drew became the controlling proprietor of the newly established People's Line. In 1847 he established the Stonington Line and in 1850 made his first venture in railroading by joining with Cornelius Vanderbilt in the purchase of the railroad between Stonington and Boston. He established the banking firm of Drew, Robinson & Co., which became one of the principal traders in railroad stocks in the country. Drew became a director and large stockholder in the Erie Railroad and at one time was said to be worth \$15,000,000. Later, principally through the failure of Kenyon, Cox & Co., in which firm he was a partner, he suffered severe losses, which drove him ultimately into bankruptcy. In his prosperous days he had been a generous supporter of the Methodist Episcopal church, erecting several church edifices, and founding

the Drew Ladies' Seminary at Carmel, N. Y., and in 1866 the Drew Theological Seminary at Madison, N. J. Consult *The Book of Daniel Drew* by Bouck White (New York, 1910).

**DREW**, JOHN (1825-62). A popular Irish-American comedian. He was born in Dublin and made his first appearance at the Bowery Theatre, New York City, in 1846. During the next 10 years he acted in the principal American cities and engaged in theatrical management in Philadelphia, where, after visits to England in 1855 and Australia in 1859, he died. Consult Moses, *Famous Actor-Families in America* (New York, 1906).

**DREW**, JOHN (1853- ). An American comedian, son of John Drew and Louisa Lane Drew. His theatrical career began under his mother's management in Philadelphia in 1873. In 1879, with Edwin Booth, Fanny Davenport, and other well-known stars, he became leading man in Daly's company, which he had first joined four years before. He figured with marked success in *jeune premier* rôles, in the revival of the classic comedies, notably as Petruchio in *The Taming of the Shrew*, and as Charles Surface in *The School for Scandal*, and also in Mr. Daly's new productions. After 1892 he appeared as a star, among his plays being *The Masked Ball*, *The Butterflies*, *A Marriage of Convenience*, *One Summer's Day*, *The Liars*, *Richard Carvel*, *His House in Order*, *Inconstant George*, *Smith*, *The Perplexed Husband*; and *Much Ado About Nothing*, *The Tyranny of Tears*, and *The Will*—the last three in 1913. He finds his best rôles in bantering, semi-ironical society characters. Consult: Strang, *Famous Actors of the Day in America* (Boston, 1900); Moses, *Famous Actor-Families in America* (New York, 1906); Winter, *Wallet of Time* (2 vols., New York, 1913).

**DREW**, LOUISA LANE (1820-97). An American actress. She was the wife of the elder John Drew and, after him, managed the Arch Street Theatre, Philadelphia, for many years. She was born in London, but came to this country and made her début in Philadelphia when about eight years old. A half-dozen years later she was playing Julia in *The Hunchback* and Lady Teazle in *The School for Scandal*. During her early career she appeared with Forrest and many of the greatest actors of the period. Her own most famous rôle was Mrs. Malaprop in *The Rivals*, which she performed with the utmost apparent simplicity. Mr. Drew, to whom she was married in 1850, was her third husband. Her sons, John and Sidney, and her daughter, Georgie Drew (Barrymore), all became actors. Consult Moses, *Famous Actor-Families in America* (New York, 1906).

**DREW**, SAMUEL (1765-1833). An English Wesleyan Methodist author, born near St. Austell, England. Until 1809 he was a shoemaker. In 1785 he joined the Methodists under the preaching of Adam Clarke. Having begun literary work when but a lad, he devoted his entire time to it after giving up his trade, and, besides editing the *Imperial Magazine*, from 1819 until his death, he published: *A Treatise on the Existence and Attributes of God* (2 vols., 1820); *Remarks upon the "Age of Reason"* by Thomas Paine (1799 and several subsequent editions); *An Essay upon the Immateriality and Immortality of the Soul* (1802); *An Essay on the Resurrection of the Body* (1809); *The Life of Rev. Thomas Coke* (1816); *The History of*



*Count Cournailles* (2 vols., 1820; 1824). Consult *The Life, Character, and Literary Labors of Samuel Drew, A.M.*, by his eldest son (London, 1834; 2d ed., 1835).

**DREWRY'S BLUFF, BATTLE OF.** See BER-MUDA HUNDRED.

**DREWS, ARTHUR** (1865– ). A German writer on philosophy, born in Uetersen, Holstein, and educated at Munich, Berlin, Heidelberg, and Halle (Ph.D., 1889). In 1898 he went to Karlsruhe as privatdocent of philosophy, and in 1908 he became professor extraordinary. He edited *Hegels Religionsphilosophie* (1905) and criticized Kant, Von Hartmann, and Nietzsche in such volumes as *Kants Naturphilosophie als Grundlage seines Systems* (1894), *E. von Hartmanns philosophisches System in Grundriss* (2d ed., 1905), *Nietzsches Philosophie* (1904), and *Die Lebenswerk Eduard von Hartmanns* (1907). *Plotin und die Untergang der antiken Weltanschauung* (1907) is a valuable historical study; and two of three parts planned of a history of nineteenth-century philosophy appeared in 1912 and 1913. He also wrote: *Die Lehre von Raum und Zeit in nachkantischen Philosophie* (1889); *Das Ich als Grundproblem der Metaphysik* (1897); and his most distinctive books, *Die Religion als Selbstbewusstsein Gottes* (1906), *Der Monismus* (1908), and *Geschichte des Monismus im Altertum* (1913). He is best known, however, especially in America and England, for *Die Christusmythe* (1910; English by Burns, 1911, and part ii, by McCabe, 1912) and *Die Petruslegende* (1910), attacking the historicity of the New Testament narrative.

**DREW THEOLOGICAL SEMINARY.** An educational institution for the training of Methodist Episcopal ministers. The seminary was founded at Madison, N. J., in 1866, and was named in honor of Daniel Drew, who donated grounds and buildings to the value of about \$275,000. The course of study extends through three years and is intended not only to give a thorough professional training, but to afford opportunity for a broad culture through the study of the humanities. The seminary degree B.D. is given only to graduates holding a prior academic degree. Advanced courses leading to the degree of D.Th. are offered. No tuition fees are charged. The seminary buildings include Mead Hall, Asbury Hall, Embury Hall, the Hoyt-Bowne Hall, the Administration Building and Chapel, the J. B. Cornell Library, the Bowne Gymnasium, and the Samuel W. Bowne Hall. The total value of the grounds and buildings is approximately \$700,000, while the endowment funds aggregate about \$1,000,000. The library is especially valuable, containing 125,000 volumes and 110,000 pamphlets. The enrollment of students in 1914 approximated 200. The president in 1914 was Ezra S. Tipple, D.D.

**DREXEL, ANTHONY JOSEPH** (1826–93). An American banker and philanthropist, born in Philadelphia. When 12 years old he entered the banking house of Drexel & Co., established in 1838 by his father, Francis Martin Drexel, and at the age of 20 he was admitted to partnership in this firm with his father and elder brother, Francis A. Drexel. In 1885 he became the nominal head of the banking system which included Drexel, Morgan & Co., of New York, and Drexel, Harjes & Co., of Paris. In 1864 Drexel, with George W. Childs, bought the *Philadelphia Public Ledger*. The most notable of his many large gifts was the total of more

than \$2,000,000 given to the Drexel Institute of Art in West Philadelphia. His will disposed of a fortune of about \$30,000,000.

**DREXEL INSTITUTE OF ART, SCIENCE, AND INDUSTRY.** An educational institution founded in 1891 at Philadelphia, Pa., by Anthony J. Drexel. The object of the Institute is to train men for the industrial demand for engineers; women to practice, superintend, and teach the industries known as domestic science and arts; and both men and women for positions in secretarial work. All the work of the Institute is thus comprised in three schools: the Engineering School, the School of Domestic Science and Arts, and the Secretarial School, special courses being offered in chemistry, architecture, and English. Extension courses are also offered, especially in the School of Domestic Science and Arts, and the evening courses in all three schools constitute one of the most valuable activities of the Institute. The courses of study are open equally to men and women; in 1914 the trustees had applied for the right to grant degrees; the requirement for admission is graduation from high school, or 14½ Carnegie units; and the tuition fees are very moderate, owing to the endowment fund established by Mr. Drexel. The main building, given by Mr. Drexel, is an imposing structure in the style of the classic Renaissance; East Hall, a finely appointed building, in the modern French Renaissance style, contains the notable collection of paintings bequeathed by John D. Lankenau. The Museum embraces specimens in every department of industrial art. In it are many examples of the decorative arts of Egypt, India, China, and Japan, and there is also an important collection of European and Oriental textiles. The Drexel Institute carries on an important educational work through the means of free public lectures and concerts. The number of students in attendance in 1912–13 was 2900 in all departments. The library, containing over 40,000 volumes, is especially well provided with works on art, science, and technology. The president in 1914 was Hollis Godfrey, Sc.D., F.R.G.S.

**DREYER, JOHN LOUIS EMIL** (1852– ). An Irish astronomer, born in Copenhagen, the son of a British army officer. He was educated at the University of Copenhagen, was assistant astronomer at the Earl of Rosse's observatory (1874–78) and assistant at the Dublin University observatory (1878–82), and in 1882 became director of Armagh Observatory. He published: *The Second Armagh Catalogue of 3300 Stars* (1886); *New General Catalogue of Nebulae and Clusters of Stars* (1888; with supplements, 1895; 1908); *Tycho Brahe* (1890); *History of the Planetary Systems from Thales to Kepler* (1906); an edition (1912) of Herschel's *Scientific Papers* for the Royal Society and the Royal Astronomical Society.

**DREYFUS, dra'fus', ALFRED** (1859– ). A French artillery officer. He was born in Mülhausen, Upper Alsace, of Jewish parentage, entered the Ecole Polytechnique in 1878, and later attended the Ecole d'Application (School of Applied Gunnery). He was appointed captain in the Twenty-first Regiment of artillery in 1889 and two years later entered the Ecole de Guerre, where he ranked among the leading 10 of his class. Within a year after leaving this institution he received an appointment on the general staff. In 1894 Dreyfus was arrested

on a charge of having sold military secrets to a foreign power. Dreyfus was isolated in prison and treated with great harshness. When he was tried, although he was allowed counsel, the court was a secret one, and he was sentenced to military degradation and solitary confinement on the Île du Diable, off the coast of French Guiana. On Jan. 4, 1895, he was conducted by a military escort to the courtyard of the Ecole Militaire in Paris, and, in the presence of a great assembly of spectators, the stripes were torn from his uniform and his sword was broken. He was then transported to the Île du Diable, and treated with severity, on one occasion being chained to his pallet for two months. He persistently denied his guilt, and this fact, together with the secrecy of the proceedings and the bitterness of the anti-Semitic agitation, led to a growing conviction in the minds of many that the real culprit had been shielded, and that it had been found convenient to put Dreyfus forward as a scapegoat.

The evidence used against Dreyfus was a memorandum, or *bordereau*, apparently in the captain's handwriting. But in May, 1896, another paper was brought to the War Office and fell into the hands of Commandant Picquart. It bore the signature of Major Esterházy, an officer of doubtful character, and the handwriting corresponded exactly with that of the Dreyfus *bordereau*, while that of Dreyfus did not. Then began a remarkable series of attempts to bring to light and to suppress the truth. The most prominent defender of Dreyfus was the novelist Emile Zola. A large part of the Liberal press also sided with the accused captain, and during the later phases of the affair his cause was adopted by the Socialists as a party issue for the time. Arrayed against him were the anti-Semitic elements of France and the powerful Nationalist influence, the latter consisting of all those who regarded the condemnation of Dreyfus as necessary for the vindication of the honor of the army, always dear to the hearts of Frenchmen. The War Office met the attacks of the friends of Dreyfus simply by asserting that the proceedings against him had been regular in every respect. There was a fixed purpose to prevent any discussion of the nature of the evidence or the facts of the case. Commandant Picquart, who showed an honest desire to bring out the truth, was made a lieutenant colonel and sent away on special service. Attempts were then made to compromise him by means of false dispatches, and he was finally removed from the active list of the army. In 1898 a new declaration was made in the Chamber of Deputies by M. Cavaignac, Minister of War. He positively asserted that Dreyfus had been justly found guilty and referred to certain documents not hitherto mentioned in the case. Colonel Picquart challenged these proofs and declared that, of the three documents upon which M. Cavaignac based his belief in the guilt of Dreyfus, two were irrelevant, and the third, the only one in which Dreyfus's name occurred, was a forgery. Six weeks later Colonel Henry, who had been connected with the intelligence department of the War Office, confessed to having committed this forgery and committed suicide. This led to a general readjustment in the organization of the general staff, and several officers were removed from the active list, but still the War Office proclaimed its belief in the guilt of Captain Dreyfus. The

Court of Cassation, however, the highest tribunal in France, had taken up the matter of revision and after several months' deliberation ordered a retrial by a court-martial. The court-martial sat at Rennes and rendered a decision that Dreyfus was guilty, but with extenuating circumstances. He was sentenced to imprisonment for 10 years, from which the period of his previous confinement was to be deducted. The members of the court-martial then united in a recommendation of mercy, and in 1899 the prisoner was pardoned by President Loubet.

The question was reopened in 1903, when a parliamentary committee of revision decided that certain "new" facts had been adduced, justifying their submission to the Court of Cassation. On the grounds that the document by which the conviction of Dreyfus in the Rennes court-martial was chiefly determined had been proven to be a forgery, and that the court-martial had failed to hear essential testimony favorable to the accused, the Court of Cassation annulled the sentence of the Rennes court-martial without ordering a new trial. Captain Dreyfus was thereby declared innocent and ipso facto restored to his old rank in the army. On the day following the announcement of the court's decision, the Chambers passed a bill raising Captain Dreyfus to the rank of major. In 1908 Dreyfus was shot at in Paris by a reactionary journalist, but escaped without serious injury. The Dreyfus affair created much excitement at the time, and the final outcome was hailed as a great triumph over militarism in France.

**Bibliography.** Captain Dreyfus's own story: *Five Years of my Life* (New York, 1901); Reinach, *Histoire de l'affaire Dreyfus* (4 vols., Paris, 1901-04); Desachy, *Bibliographie de l'affaire Dreyfus* (ib., 1905).

**DREYSCHÖCK**, drī'shök, ALEXANDER (1818-69). A Bohemian pianist, born at Zach, Bohemia. As a pupil of Tomaschek, at Prague, he developed a technique marvelous for his time. "The man has no left hand. He has two right hands," was J. B. Cramer's exclamation after hearing him play. In 1828 he began concert touring and continued to do so successfully for 20 years. In 1862 he was appointed a professor in the Conservatory of Music at St. Petersburg, where he remained until 1868, when failing health compelled him to go to Italy. His compositions are of the salon order and unimportant. He died in Venice.

**DREYSE**, drī'ze, JOHANN NIKOLAUS VON (1787-1867). A German inventor. He was born in Saxony, served an apprenticeship with his father, a locksmith, and then worked for a time in a musket factory in Paris. In 1814 he founded an ironware factory in Sömmerda and became interested in the manufacture of firearms. In 1827 he invented a muzzle-loading, and in 1836 a breech-loading, needle gun, the adoption of which by the Prussian army four years later led to his founding an extensive gun and ammunition factory. He was ennobled in 1864.

**DRIESCH**, drēsh, HANS (1867- ). A German biologist, born in Kreuznach, Rhenish Prussia. He was educated at the Hamburg Johanneum and at the universities of Freiberg, Munich, and Jena. He traveled in Ceylon, Burma, India, and Java in 1889 and in 1893, and in 1891-1900 worked at the Naples Stazione Zoologica. Settling at Heidelberg in 1900, he became privat-

docent (1909) and professor extraordinary (1911) of philosophy. Gifford lecturer at Aberdeen in 1907-08, he received the honorary degree of LL.D. from that university in 1910. He was one of the founders of "vitalistic" biology. Besides biology, and particularly experimental morphology of animals (parthenogenesis, regeneration of lost parts), he devoted himself to natural philosophy and logic. He contributed to the *Archiv für Entwicklungs-Mechanik*, the *Zeitschrift für wissenschaftlichen Zoologie*, etc., and published: *Die mathematisch-mechanische Betrachtung morphologischer Probleme der Biologie* (1891); *Die Biologie als selbständige Grundwissenschaft* (1893; 2d ed., 1911); *Analytische Theorie der organischen Entwicklung* (1894); *Die Localisation morphogenetischer Vorgänge* (1899); *Die organischen Regulationen* (1901); *Die "Scele" als elementarer Naturfactor* (1903); *Naturbegriffe und Natururteile* (1904); *Vitalismus als Geschichte und als Lehre* (1905); *The Science and Philosophy of the Organism* (1908-09); *Ordnungslehre* (1912); *Logik als Aufgabe* (1913); *The Problem of Individuality* (1914).

**DRIFT** (from AS. *drifan*, Icel. *drífa*, Goth. *drieban*, OHG. *triban*, Ger. *treiben*, to drive), or **GLACIAL DRIFT**. A name applied to glacial deposits in general that were formed during the Pleistocene period. The great ice sheets which at that time covered the northern parts of North America, Europe, and Asia were efficient agents of erosion and transportation. Vast masses of loose materials, including earth, sand, and stones, were conveyed on their surface or in their lower portions, and on the retreat of the ice the materials were left behind as a compact, structureless deposit of variable thickness. The drift is variously called till, bowlder clay, ground moraine, and older diluvium. It quite frequently occurs in ridges or hillocks (drumlins, kames, and eskers) in the formation of which the action of streams that resulted from the melting of the ice is apparent. The stones in drift have a characteristic appearance and surface. They are usually of oblong shape, highly polished, and have rounded edges. When the rock is fine-grained, numerous striæ may be seen running parallel to the longer axis of the fragment. Sometimes the stones have been transported long distances. The peculiar syenite known as laurvikite, which occurs in the vicinity of Laurvig, in southern Norway, has been found in the drift of Denmark, in Germany, and even in Yorkshire, England. Drift deposits, when separated by an intervening stratum of non-glacial material, show changing conditions as to the advance and retreat of the ice sheet. See **GLACIER**; **GLACIAL PERIOD**; **DRUMLIN**; **ESKER**.

**DRIFT OF A PROJECTILE**. The divergence of the projectile from the plane of departure due to the rotation of the projectile, its ballistic character, and the resistance of the air. It is generally in the direction of rotation, except for extreme elevations of high-angle fire, in which case it may be opposite to the original direction of rotation. For the United States service rifled guns it is to the right. It may be expressed either in yards or angular measure. See **BALLISTICS**, especially the section on *Exterior Ballistics*.

**DRIFTWAY** (AS. *drifan*, to drive). A right of way for driving cattle. Such a right exists, as a *public right*, in highways, unless restricted by statute or the terms of the dedication of the

highway, or it may exist as an *easement* over the land of another, acquired by grant or prescription. Not every easement of a way is a driftway, however, nor even every general right of way—the latter being commonly restricted to the more usual purposes of a way, as passing and repassing on foot or with horses and wagons. A way "for all purposes" has, however, been held to include a driftway. See **EASEMENT**; **HIGHWAY**; **WAY**.

**DRILL** (from Dutch, Ger. *drillen*, to drill, connected ultimately with AS. *ȝrelian*, to bore, Eng. *thrill*). In the broadest meaning of the word a drill is a tool used in boring or making holes in rock, metal, bone, ivory, wood, etc. Drills for boring wood are described under **BORING MACHINES**. Rock drills, or rock-drilling machines, are a separate class of tools and are described separately below. Drills for metal, bone, ivory, etc., are made in several forms. One form consists of a square steel bar flattened out at the cutting end. This end is brought to an angular point like a spearhead, and the cutting edges forming the angle are beveled in opposite directions. Those which have a projecting pin in the centres and chisel-shaped cutting edges on each side of the pin are called centrebits. There are various contrivances by which the drills are made to revolve. For drilling iron, steel, and large brass work, the drilling machine (see **METAL-WORKING MACHINERY**) is commonly used. The best and most generally used drills for small boring are called twist drills, which have many advantages over the flat drills described above. Twist drills are made from steel rods of uniform diameter throughout their length. Upon the rod two spiral grooves are cut, each starting at the cutting edge at diametrically opposite points. At the end of the drill the grooves almost meet in the centre of the rod, but grow shallower as they continue. The cutting edges are ground on the end of the rod, and the borings escape through the grooves, which constantly carry them away from the cutting edge, thus preventing . . .

**Rock Drills**. These may be subdivided into two general classes, percussion and rotary drills; they may be operated either by hand or by mechanical means. With the percussion drill the advance in the rock is made by striking the face of the hole with a chisel bit, whereas in the rotary type it is made by the grinding or milling action of an annular bit forced against the face of the hole.

**PERCUSSION DRILLS**. The simplest form of percussion drill operated by hand is known as the hand drill. It consists of a bar of steel having a chisel-shaped cutting edge which is struck with a hammer and slowly rotated between each striking. From one to three men are employed in this work; when more than one man is employed, one man turns the drill and adds water to the hole, while the others strike the drill. In soft formations holes can be drilled by merely churning and rotating a heavy bar of drill steel. This practice, known as churn drilling, is very common when a comparatively small amount of drilling is to be done. Mechanical means are employed for large scale work in both cases.

**Power Percussion Drills** may be subdivided into the reciprocating and hammer types. The former may be operated either by steam or by compressed air, whereas the latter, which is

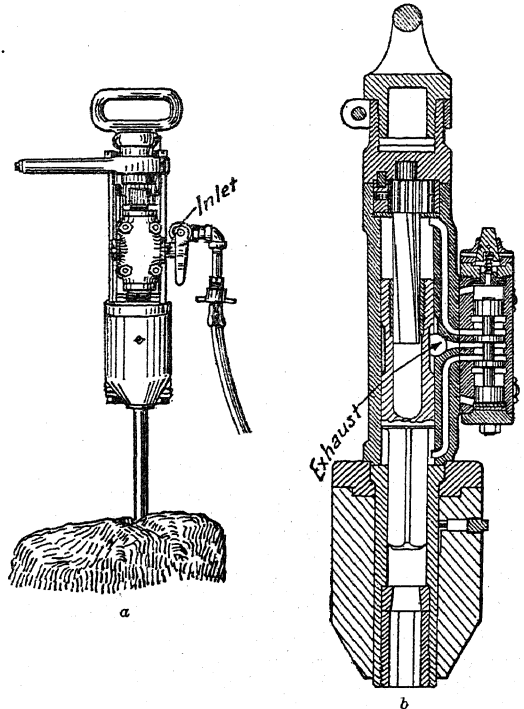
of recent invention, can be operated only by compressed air. When compressed air is used, it is necessary to store it in a reservoir where the precipitated moisture resulting from compression can be drawn off; otherwise the air delivered to the drill will be wet, and on expansion of the air this moisture will freeze, causing trouble at the drill. (See AIR COMPRESSOR.) The first American reciprocating percussion drill was patented by J. J. Couch, of Philadelphia, Pa., in March, 1849. In May of the same year Joseph W. Fowle, who had assisted Couch in developing his drill, patented a reciprocating drill of his own invention. The Fowle drill was improved by Charles Burleigh and was first used in the Hoosac Tunnel. In Europe Caré patented a reciprocating drill in France in October, 1856. This invention was soon followed by several others; but it was not until Sommeiller's drill, patented in 1857 and perfected in 1861, was used on the Mont Cenis Tunnel that the problem of a reciprocating drill was practically solved abroad. Since that time numerous reciprocating-drill patents have been taken out in both America and Europe.

A *Reciprocating Drill* consists of a cylinder secured to a cradle, or shell, which in turn is mounted on either a tripod or a column. A long piston rod which works in the cylinder is supported in such a manner that a drill clamped to the end of the piston rod alternately strikes and is withdrawn from the rock as the piston reciprocates back and forth within the cylinder. Means are provided by which the piston rod and drill turn slightly on their axis after each stroke, and also by which the drill is put forward or advanced as the depth of the hole increases. There are various special forms of reciprocating drills, which differ from each other chiefly in the methods by which the valve is operated. All of these drills work either with direct steam pressure or with compressed air. The illustration is a longitudinal section, showing the interior construction of a common form of reciprocating drill to be operated by steam or compressed air. The steam or compressed

air is admitted at *A* to the chest, *B*. From *B* the slide valve, *C*, by moving back and forth, admits the steam or air behind, first, one end and then the other of the long-barrel piston, *D*. This slide valve is operated by the three-arm rocker, *E*, which is swung to and fro by the movement of the piston.

The *Hammer Type* of percussion drill was originally designed for the use of the machinist for calking, chipping, and riveting in boiler work. George Lyner, of Denver, seeing the advantage of such a type of drill, placed on the market in 1898 the first successful hammer drill. Further improvements have resulted in the successful development of a light-weight one-man hammer drill, commonly called a butterfly drill, which consumes only about 50 per cent of the amount of air per foot drilled as

the reciprocating type. One of the latest types is a self-rotating hammer drill, especially designed for back stopping. This drill consists of a barrel or cylinder in which a hammer pis-



SELF-ROTATING PNEUMATIC HAMMER DRILL.  
a. Elevation. b. Section.

ton is operated by air. The steel is inserted in one end of the cylinder, and to the other end is attached a telescope tube by means of which the cylinder holding the piston and drill steel is moved forward by compressed air as the drill hole is advanced. The drill steel is rotated mechanically by means of a sleeve connection between the drill steel and a raffle bar, quite similar to that of the reciprocating type. The shank of the drill steel extends a sufficient distance into the cylinder to receive the blow of the rapidly moving hammer piston. This type of drill is meeting with much favor.

*Electric Percussion Drills* are built, but have not up to the present time met with favor. The reciprocating and hammer drills are used almost entirely for holes for blasting purposes.

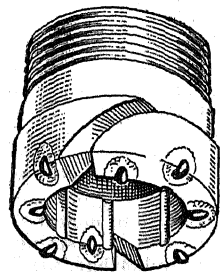
*Churn Drilling.*—For drilling vertical holes of larger diameter, such as artesian wells, oil wells, and prospecting ore deposits when the ground is badly fractured or fissured, the churn drill operated by power is used. The surface plant consists of a high derrick, an engine operating a walking beam, and a steam boiler. A churn-drill equipment with derrick engine and boiler may be, for ready transportation, mounted on wheels. The drilling tools, known as a string of tools, consist of a rope socket, sinker bar, jars, auger stem, and bit. The jars are placed midway in the string of tools and resemble two long links of a heavy chain; their object is to permit of an upward blow in case the drill becomes stuck in the hole. The drill rope, which is coiled on the

drum, passes from the drum up over a sheave in the top of the derrick and down to the string of tools in the hole; for drilling, this rope is attached near the surface, by means of a clamp, to the temper or feed screw, which in turn is attached to the walking beam. Water is added to the hole while drilling, and the crushed rock or sludge is extracted by use of a sand pump.

Many other types of churn drills are employed, which are discussed in various special works on this subject. See WELL SINKING.

**ROTARY DRILLS.** When it is desired to receive a core or section of the formation drilled to examine the structural or mineralogical character, core drills of the rotary type are used. These may be subdivided under the two heads of diamond drills and shot drills. Instead of making the advance in the rock by percussion, the rotary drill, consisting of hollow drill rods to which is attached an annular bit, makes its progress by a boring action produced by rapid rotation. Only an annular ring is cut in the formation by the bit, thereby leaving a core or section of rock which enters the opening in the bit and drill rods. On withdrawing the rods from the hole the core of rock which is incised in the rods is brought to the surface, where it can be examined, sampled for assay, or stored in a core box for future reference. The rotary drill is largely used for prospecting mineral deposits, testing bridge foundations and concrete, and general exploration work when one desires a sample of the formation from below the surface. The two heads under which the rotary drill may be subdivided are known as the diamond drill when diamonds are set in the bit, and the shot drill when a soft steel bit is used and the cutting is done by the addition of steel shot.

**Diamond Drilling.**—The application of the diamond drill is for deep holes less than 2 inches in diameter. The cost of diamonds prohibits the drilling of larger holes. The angle of the hole should be below the horizontal if possible, although holes have been drilled at angles above the horizontal and a few almost approaching the vertical. Holes exceeding 5000 feet in depth have been drilled in South Africa. The drilling equipment consists of a water swivel, drill rods, core barrels, core lifter, and diamond bit. The drill rods consist of heavy pipe, a core barrel of extra heavy pipe about 10 feet long, a core lifter containing a steel ring for gripping the core of rock as the rods are withdrawn from the hole, and a bit, consisting of an annular ring of soft steel in the face of which is set an even number of diamonds in such a way as to cover the entire annular face. An eight-stone diamond bit will contain about 12 carats and will have a value of from \$700 to \$800. The drill is rapidly revolved, and the cutting is done by the diamonds. It is necessary to feed water constantly through the rods

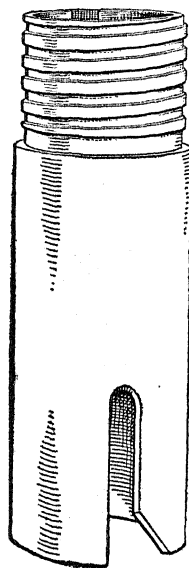


DIAMOND DRILL BIT.

to the face of the bit to wash away the pulverized rock and keep the bit and diamonds cool. The pressure of the drill bit on the face of the

hole is regulated by a hydraulic feed or an adjustable screw feed.

**Shot Drills.**—For vertical or nearly vertical holes exceeding 2 inches in diameter the shot bit has replaced the diamond bit. In addition to the uses to which the diamond drill is applicable, the shot drill can be used for drilling ventilating holes in mining operations, and it has been used by the United States government in drilling a short hole 30 inches in diameter at an angle of 30°. At Astoria, L. I., a 10-inch vertical hole was drilled to a depth of 2002 feet with a shot bit. The drilling tools consist of a water swivel, drill rods, calyx, core barrel, and bit. The drill rods consist of heavy pipe much smaller than the diameter of the hole. The calyx is a pipe only slightly smaller than the diameter of the hole surrounding the drill rod, and serves as a cup or reservoir to catch the sludge as it is washed from the face of the hole. The core barrel is a heavy pipe attached to the lower end of the calyx to retain the core after it is cut. The bit consists of soft steel. The drill is rapidly revolved, and the cutting is done by a milling action of steel shot fed into the drill rods and washed to the cutting face of the bit. It is necessary to feed water constantly through the rods to the face of the bit to wash away the pulverized rock and keep the bit cooled. The feeding, or advancing, of the drill rods is similar to that of the diamond bit.



BIT FOR SHOT DRILLING.

For additional information on rock drills, consult: Redmayne, *Modern Practice in Mining* (4 vols., New York, 1911); Foster, *Elements of Mining and Quarrying* (1b., 1905); Dana and Saunders, *Rock Drilling* (London, 1911); and the catalogues and bulletins of manufacturers.

**DRILL** (Dan. *drille*, bore, Dutch *drillen*, to bore). In agriculture, an implement employed for planting, or drilling, seeds in regular rows as distinguished from hand or broadcast sowing, which was almost universally practiced until about the middle of the last century. It is said that a sort of drill plow was developed in Assyria long before the Christian era and that the Chinese used a similar implement 3000 to 4000 years ago. Jethro Tull, however, early in the eighteenth century invented the first implement in any way comparable with the modern drill and showed its merit in the culture of grain and root crops. The first patent for a seed drill granted in America was to Eliakim Spooner in 1799, but nothing is now known of the nature of his device. Many patents followed, but M. and S. Pennock, of Pennsylvania, were probably the first (in 1841) to manufacture and sell any considerable number of seed drills. A great variety of drills are now in use, distinguished from one another mainly by the type of furrow opener or covering device used, as, e.g., hoe drills, shoe drills, double and single disk drills, press-wheel drills, and those using a chain-cov-

ering device. Drills with a single-disk furrow opener and a chain-covering device are coming to be preferred to other forms. Drills are sometimes adapted to the simultaneous distribution of fertilizers and seed, but this is accomplished by means of a fertilizer attachment, as the two cannot be effectively applied by means of the same mechanism. One great recommendation of drilling is that it effects a considerable saving and more uniform distribution of seed, and a further advantage is that it permits cultivation and hence promotes conservation of soil moisture. See IMPLEMENTS, AGRICULTURAL.

**DRILL.** A general title for the various systems of exercises and methods of instruction by which organized bodies of men are made uniformly efficient and effective for the purposes of the organization of which they are a part. Specifically it has direct reference to the different details of training by which soldiers and sailors are organized and qualified for their duties. In the United States army the manuals for the different arms of the service are called *drill regulations*. These include not only *drill proper*, i.e., disciplinary exercises designed to teach precise and soldierly movement and subconscious obedience on the part of the individual soldier, but also *field and combat exercises*, designed for the tactical training of officers and organizations. (See INFANTRY; CAVALRY; FIELD ARTILLERY; COAST ARTILLERY; DRILL REGULATIONS.) The various European manuals of drill were based originally on the Prussian system of Frederick the Great and have been adapted since to such particular needs of the nations as have been dictated by national evolution and the improved inventions of modern scientific warfare. See TACTICS, MILITARY; MANUAL OF ARMS.

In the United States navy the drills are very numerous. In addition to the fleet or squadron drills, which comprise fleet tactics, battle tactics, and numerous special exercises, the drill of crews of ships comprise: clearing ship for action; general quarters (drill at stations for battle); fire quarters and fire drill; collision drill; battery drill, including drill at the heavy guns and secondary battery and supply of ammunition, instruction at the guns, etc.; torpedo drill and instruction; target practice (q.v.), with all calibres of guns, with full-calibre ammunition, subcalibre ammunition, record practice, preliminary practice, battle practice, small-arm practice, aiming drill, etc.; field-artillery drill with 3-inch field guns; infantry drill, including manual of arms and tactics, and exercise as a landing party or body of infantry making a landing and then operating on shore; boat drills, exercise with oars, with sails and tactical drill; also many other special drills, as coaling-ship drill, "man overboard," etc. In the older ship there are also sail drills, spar drills, etc. See GUNNERY; TACTICS, NAVAL.

**DRILL.** Any of several small gastropods which bore through the shells of other mollusks and suck out their juices, such as species of *Natica*, *Purpura*, *Anachis*, *Astyris*, *Tritia*, *Ilyanassa*, and others. The most numerous in the waters off the east coast of the United States, and most troublesome, is *Urosalpinx cinerea*, which is exceedingly destructive of oysters on cultivated beds. It is this which is the common "drill" of the oyster beds; and it is its eggs, laid in small vase-shaped capsules, which are often found in groups attached to the under surface of stones. The natural home of the drill is the

tide pools and weedy borders of rocky shallows, where barnacles, hydroids, anemones, rock-loving limpets, and other associated forms that find shelter among the algae afford it abundant food. Though this is precisely where the mussels grow till the rocks are almost black with them, it is said that they are never attacked by the drills. The increase of these mollusks when they colonize upon an oyster bed is very rapid, and the damage serious; but it is very difficult to combat them and perhaps impossible to get rid of them. Consult Goode, *Fishery Industries*, vol. i, p. 696 (Washington, 1884), and Ingersoll, *Oyster Industry of the United States* (ib., 1882).

**DRILL** (from *mandrill*, baboon, probably a West Indian word; divided by popular etymology into *man* + *drill*). A West African baboon (*Cynocephalus*, or *Papia, leucophaeus*), similar to the mandrill (q.v.). See BABOON, and Plate of BABOONS.

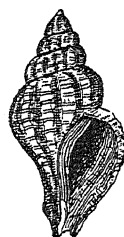
**DRILL** (abbreviation of *drilling*, Ger. *Drillich*, OHG. *drilich*, ticking, from Lat. *trilex*, three-threaded, from *tres*, three + *licium*, thread; associated by popular etymology with Ger. *drei*, three + termination *-ing*). A fine heavy twilled linen or cotton fabric of a satiny finish.

**DRILL REGULATIONS.** Official manuals prescribing for the different arms of the service the methods of training and instruction, their formations, manœuvres, and ceremonies, and in a limited sense their battle tactics. The forms in which the units of organization learn their duties and perform them, at rest and in motion, are embodied in the drill regulations prescribed by the various nations. They are, from their nature, next to organization, the foundation for the tactics of an army.

Drill regulations are undergoing constant change, due to improvements in firearms and the experiences of the most recent wars as well as the improvements in other fields of science. Those for the various branches of the line—cavalry, infantry, artillery—are comparatively stable, although even these are changed almost every decade. Those for coast artillery must change with every alteration or improvement in the piece, its carriage, the emplacement accessories, and the electrical power and communication systems. See ARMY ORGANIZATION; DRILL; TACTICS, MILITARY.

**DRY/MYS.** See WINTER'S BARK.

**DRINKER, HENRY STURGIS** (1850– ). An American university president, born in Hong-kong, China. In 1871 he graduated from Lehigh University, and in 1878 he was admitted to the bar. Between these dates he had had charge of the building of the Musconetcong tunnel for the Lehigh Valley Railroad; by this road he was later retained during a long period as general solicitor (1885–1905). In 1905 he became president of Lehigh University. He received the degree of LL.D. from Lafayette College, Franklin and Marshall College, and the University of Pennsylvania. Besides editing a revised edition



A DRILL.  
Shell and Egg Capsules (a) of *Urosalpinx cinerea*.



of Ball's *General Railroad and Telegraph Laws of Pennsylvania* (1884), he is author of *Tunneling, Explosive Compounds, and Rock Drills* (1878; 3d ed., 1882).

**DRINKER MOTH** (so called from its long proboscis). An English foliage-destroying moth (*Odonestis potatoria*), closely allied to the egger.

**DRINKHOUSE**, EDWARD J. (1830-1903). An American clergyman and editor, born in Philadelphia. In 1850 he joined the Maryland Conference of the Methodist Protestant church. Ill health compelled him to retire from the ministry for a time, and he went to California. In 1865 he received the degree of M.D. from Toland Medical College, San Francisco. He was editor of the *Methodist Protestant* for 18 years and was one of the foremost leaders of his denomination, whose history he published as *History of Methodist Reform Synoptical of General Methodism, 1703 to 1898, with Special and Comprehensive Reference to its Salient Exhibition in the History of the Methodist Protestant Church* (2 vols., 1899).

**DRINKING USAGES.** As religious observances, drink offerings were common among the ancients, both Jews and pagans. To mark the spot where he communed with God, Jacob set up a pillar of stone and "poured a drink offering thereon" (Gen. xxxv. 14), and women are said to have poured out drink offerings unto other gods (Jer. vii. 18). On occasions of solemn prayers and before their eating and drinking, the Greeks and Romans poured from the cup to the ground a small quantity of the liquid—either undiluted wine, milk diluted with water, or water flavored with honey. A relic of the custom was recently noted in the island of Samos. The health-drinking custom comes from antiquity. Homer's Odysseus, when about to leave the Phæacians, rises from the couch and places the drinking bowl in the hands of Alcinoüs' wife with the words "I drink to you; be happy." So, too, with the early Romans, the drinking of healths was a common custom, simply observed with a homely formula. Plato and Xenophon have described the famous *symposia*, or drinking parties, of the Greeks, which, under the name *commissatio*, came into vogue in Rome under the Empire. These followed the feast and were enlivened by games, riddles, and the music of the lyre. Wine and water were mixed for the whole company in a *crater* (bowl), from which the *pocula* (cups) were filled. One of the party formally elected to the office of *arbiter bibendi* (master of the revels) decided the strength of the beverage, the toasts to be drunk, and other matters connected with the festivities; or less formally each guest suited his taste in the mixing of the wine and water. Frequently the number of letters in the name of the one whose health it was proposed to drink decided the *cyathi* (measuring cups) of wine (Martial, xi, 37). When a person drank wine with another, he first tasted of the cup himself and then handed it to his friends, with the words *Propino tibi* (I drink to you)—or, more colloquially, *Bene vos*—and received his cup in return. Among the Celts and Germans a similar custom existed, but without such ceremony. There was a common bowl of wine; the first to drink took a sip, turning to his neighbor with an "I drink to you," and the bowl made the rounds of the table. There was no trace of the libation to the gods which was customary among the Greeks and Romans.

The Christians took up the pagan custom and in their feasts expressed good wishes for the bodily health and future welfare of their friends. An abuse crept in which savored of idolatry and profanation—the drinking to the dead and to the saints. This latter custom was anathematized by a council at Nantes and gradually fell out of use; but drinking to the dead is not uncommon even to-day. It has been said that the practice of saying "I'll pledge you" originated during the tenth century, when the English were fearful of the treachery of the Danes. When one of the company stood up to drink to another, the bow raised high with both hands and his back exposed to a murderer's blow, his companion next him stood up also and raised his drawn sword to defend him while drinking; he was his *pledge*, responsible for his protection. The *wassail bowl* became the *poculum caritatis* of the monastery. On New Year's Day it was placed before the abbot, and from it the superior drank to all, and the rest in succession to each other. Hence the origin of the "grace cup" of the universities and the "loving cup" of the corporation feasts in London, whose formalities recall those connected with the ancient wassail bowl. After dinner the master and wardens "drink to their visitors in a loving cup and bid them all heartily welcome." The cup (a silver flagon containing warm spiced wine) then circulates round the table, the person who pledges standing up while his neighbor drinks to him.

Excessive gallantries accompanied the drinking of healths during Elizabethan times. Just as the Roman lover wrote his mistress's name with wine on the tables, the English gallant would write it with his blood or even stab his arm and drink to her health in his blood. Drinking healths on the knees, often with the knees bared, was of common occurrence. And doing honor to a lady by tossing into the fire some jewel or ornament of dress, with a bidding to their companions to follow, was a custom among lovers even as recent as the nineteenth century. The Puritans would have no drinking of healths but with the restoration of Charles II the custom was again carried to excess. See TOAST.

Many old drinking usages, still kept alive by the class that clings to old traditions, are connected with occasions of birth, baptism, marriage, and death. The gloomy festivity of the *lykewake*, or wake, over the corpse of the deceased in Scotland and Ireland, and the former drinking of the *dredgy* (dirge) after funeral solemnities, are relics of very ancient customs.

As regards miscellaneous drinking observances at one time common, we can refer but to few of the more prominent. Apprentices, on being introduced to a workshop, paid so much entry money to be spent in drink. Similar exactions were made from journeymen on entering a new employment. This was called "paying their footing." When Benjamin Franklin, on getting employment in a printing office in London, refused to comply with this mischievous custom, he experienced, he tells us, a variety of petty annoyances. Among shipwrights the penalty of non-payment was flogging with a handsaw from time to time and other maltreatment. Happily the abolition of these usages has kept pace with the increasing intelligence of the working classes, but even nowadays the last student entering the French *atelier* must treat the rest. From the novels of Smollett and others, it appears that prisoners, on being lodged in jail, were obliged



to pay *garnish* for drink to the brotherhood of which they had become members. The efficacy of modern prison discipline has done away with such exactions.

The giving of *vails* (Lat. *vale*, farewell) to servants on quitting a gentleman's house—a custom which became so intolerable in the eighteenth century as at length to be given up by universal consent—meant, doubtless, a gift to be spent in drink to the health of the donor and was analogous to the custom of giving a *Trinkgeld* in Germany and a *pourboire* in France to servants, drivers of carriages, and others. There were at one time numerous drinking usages connected with departures. We need notice only the *bonailie* (Fr. *bon aller*), or as it is sometimes called, a *foy* (Fr. *voie*), a festive drinking at the going away of servants or of persons of higher rank—a custom once common in the Lowlands of Scotland; also the *stirrup cup*, or, as it is called in the Highlands, *deoch an dorris*, or drink on getting on horseback and being ready to set off. For the decline of drinking habits in general, see the article *TEMPERANCE* in this *ENCYCLOPÆDIA*. Consult: Dunlop, *Drinking Usages of Great Britain* (London, 1839); Mew and Aston, *The Drinks of the World* (ib., 1893); Hackwood, *Inns, Ales, and Drinking Customs of Old England* (New York, 1909).

**DRIPMOLDING.** See *DRIPSTONE*.

**DRIPSTONE.** A projecting molding or tablet placed over the head of a Gothic doorway or window for the purpose of throwing off the water, whence it is also known as a water table or weather vane. Though such was, no doubt, its purpose at first, it latterly became a mere ornamental appendage, which served to enrich and define the outline of the arch. It does not generally extend lower than the springing of the arch. When the tracery extends to a lower level, the external dripstone usually accompanies it, and Parker mentions that at the north doorway of Otham Church, Kent, it descends the whole length of the jamb. The dripstone is less common a feature in Continental than in English Gothic.

**DRISLER**, dris'lër, HENRY (1818-97). An American classical scholar, born on Staten Island, N. Y. He graduated at Columbia in 1839, was appointed tutor of Greek and Latin there in 1843, and adjunct professor of Greek and Latin in 1845. From 1857 to 1867 he was professor of the Latin language and literature and from 1867 until 1894 Jay professor of the Greek language and literature. In 1894 he became professor emeritus. He was acting president of Columbia in 1867, during the absence of President Barnard as United States Commissioner to the Paris Exposition of that year, and again in 1888-89, after the retirement of President Barnard and previous to the election of President Low. In 1890-94 he was the first dean of the Columbia School of Arts. He assisted Anthon (q.v.) in the preparation of a series of textbooks and brought out an American edition, with corrections and additions (1851), of the *Greek-English Lexicon* of Liddell and Scott. In 1858 he revised and enlarged Yonge's *English-Greek Lexicon*. Later, he rendered such important service in the revision connected with the sixth, seventh, and eighth Oxford editions of the *Greek-English Lexicon* of Liddell and Scott (1874; 1883; 1897) that these editions show his name on the title-page.

**DRIVER**, drî'vër, SAMUEL ROLLES (1846-1914). An English biblical scholar, born at Southampton. He graduated B.A. at Oxford (1869), was fellow and tutor (1870-83), succeeded Pusey as regius professor of Hebrew and canon of Christ Church, Oxford, in 1883. Among his publications are: *A Treatise on the Use of Tenses in Hebrew* (1892); *Notes on the Hebrew Text of the Books of Samuel* (1890); *Isaiah: His Life and Times* (1893); *An Introduction to the Literature of the Old Testament* (1897); commentaries and annotations on Leviticus (1894-98), Deuteronomy (1895), Joel and Amos (1897), Daniel (1900), Genesis and Exodus (1911). With Francis Brown and Charles A. Briggs he published *Hebrew and English Lexicon of the Old Testament* (New York, 1906).

**DRIVER ANT**, or **VISITING ANT**. A West African doryline ant (*Anomma arcens*), nearly  $\frac{1}{2}$  inch long and blind, which goes about, mainly at night, in "armies" that destroy all the smaller creatures overtaken. When they reach a village, the negroes are obliged to quit their houses as long as the ants remain, and "all the rats, mice, lizards, cockroaches, and other vermin . . . are either compelled to decamp hastily or are caught, killed, and devoured." They are said to have no fixed abodes, but to follow a nomadic life, crossing rivers by clinging to one another in a living chain, or bridge, over which others pass; or, when aroused by floods, drifting in spherical masses and floating in drift ashore. A very complete account of their habits is given by Wilson in *Western Africa* (New York, 1856), from which the following facts are quoted: "When about to cross a well-trodden path where they [the column] are likely to be disturbed, the soldiers weave themselves into a complete arch, extending across the whole width of the path, under which the females and the laborers bearing the larvæ pass without the least exposure. I have frequently put the end of my cane under the arch and raised it full five feet from the ground without letting a single ant fall." Also consult: Savage, "On the Habits of the Drivers, or Visiting Ants of West Africa," in *Transactions Entomological Society, London*, vol. v (London, 1847), and *Proceedings Academy of Natural Science, Philadelphia*, vol. iv (Philadelphia, 1847); Wheeler, *Ants* (New York, 1910).

**DRIVING** (from *drive*, AS. *drifan*, Icel. *drifa*, Goth. *dreiban*, OHG. *triban*, Ger. *treiben*). The art of driving one or more horses with the greatest security and comfort to all concerned is as important to the horse as to the driver; and yet, notwithstanding the experience of centuries, its finer points remain unknown to many men and women who are in the regular habit of driving, whether for business or pleasure. Pleasure driving is usually confined to a single horse, or a pair in double harness side by side, or a pair tandem fashion. Modern conditions of road and street traffic compel the adoption of definite rules for each of these and demand that the thoroughly equipped driver be at all times ready and able to adjust himself to circumstances as they vary from moment to moment. Above all, a connection or bond of sympathy should be established between the driver's hands and the horse's mouth, so that prompt indication may be made of any intention to change the direction. In driving a single horse the

driving, or left, arm should be held easily and sufficiently forward for the right arm to be able to come to its assistance, with sufficient space between the rein hand and the body to insure the possibility of drawing the reins in without swaying the body backward. The third or fourth finger should press on the reins, preventing them from slipping. When the right hand is needed to aid the left, the second, third, and fourth fingers of that hand are placed between the reins, and the first and second placed on the right rein, grasping it, but keeping each rein of equal length. To turn to the right, bend the wrist over in such a manner as to bring the thumb undermost towards the left hip; and for a turn to the left, bring the little finger undermost and incline it towards the right hip. The driving (left) hand must be held straight in the centre of the body, with the knuckles of the hand to the front, and the forearm exactly square to the upper arm, the elbow and back of the fingers (when shut over the reins) lightly touching the (driver's) coat. The whip is held in the right hand, grasped in such a manner as will give it the best balance, either for carrying or for service. With a well-made properly balanced whip this would be about 15 or 16 inches from the butt. If bearing reins are used, care must be taken that they are never so short as to fret the horse. A slight drawing of the reins—pulling them sufficiently taut gently to “feel” the horse's mouth—indicates to the properly trained horse the signal to move off. *Driving two horses abreast* is effected in the same manner, there being but two reins in the driver's hands. When two horses are driven *tandem* fashion, the one before the other, four reins come into use, and much of the practice of four-in-hand driving applies.

For *coach*, or *four-in-hand*, *driving* the reins should be of a width and thickness regulated by the length of the driver's fingers. Before mounting take in the left hand the rein that draws through the centre of the terret of the left-hand wheeler's pad (this is the near-side leader's rein) and draw it until it bears on the bit. Next pull the right leader's rein through in the same manner and pass them to the right hand. Then pull first the left and then the right wheeler's reins through the finger spaces of the left hand. Having assembled all the reins in the left hand, pass them between the corresponding fingers of the right hand, leaving the left hand free to grasp the rail and mount to the driving seat. In mounting the left foot is placed on the wheel box, the right on the splinter bar, followed by the left foot on the step and the right foot on the footboard of the box, whereupon the driver speedily seats himself. Once seated, the feet are brought close together; the left hand so placed that it will be on a level with the lowest vest button, the forearm as nearly as possible horizontal, and, similarly, the hand in the centre of the body, which it touches with the back of the fingers, the knuckles being straight to the front.

The wrist must be able to work backward and forward like a spring. The horses are notified to start by lightly drawing in the reins so as to secure a slight pressure on every horse's mouth, after which a sign or a cry will notify the grooms to stand clear, and the horses will move off together. The team must be started at a walk, and the driver be prepared to hold in the leaders. Never use the whip unnecessarily, and before doing so, in any event, have all the horses

well in hand. To shorten the reins, take them between the fingers of the right hand and pull them back through the fingers of the left. To ease the left hand, change the reins into corresponding position in the right, but only when on a straight, clear road. Keep the leaders slightly in, so that their traces are slack. Go uphill at a trot, or even at a gallop, as it keeps the team more even. Downhill the horses should be well in hand. To turn to the right, take the right-hand leader's and wheeler's reins about 8 inches away from the left hand, and pull them until the right hand is near the body; drop the left hand gently, then, as the team comes round to the right, steady the right-hand horses, ease out the reins of the left-hand ones, and the team will straighten out. The turn to the left is a reversal of these methods. Stop gradually, taking in first the leaders' reins, then the wheelers'. Bring the team down to a slow trot and let them be almost at a walk before coming to a full stop. Pass the reins to the right hand and dismount.

*The position of the reins in the driving hand is a much-disputed point, and one to which too much importance cannot be attached. Driving in America has naturally been considerably influenced by the methods employed in England; and the “tooling” of fashionable coaches is still apt to be after the English fashion. The strictly American method of holding the reins is seen in Figs. 1 and 3, the latter being known as the “clubbed hand.”*

When all the reins are held in one hand, a rein in each finger space, it is called a “full hand” (Fig. 2), a method once very popular on the continent of Europe and even now considered good form in France. The great objection to the method, however, is that the off-wheel rein, on top of the little finger, cannot be firmly held, owing to the insufficiency of strength in that finger. In Switzerland and Italy the professional coachmen employ many different methods of handling, although all of them seem to be opposed, in practice at least, to the old French custom, or “full hand,” already explained. The method of the Saint-Moritz diligence (Fig. 4) is perhaps the best method employed on the Con-

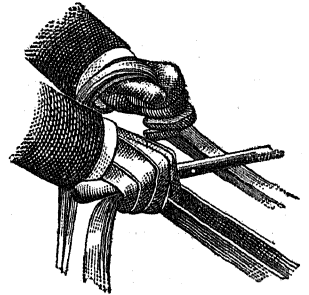


FIG. 1.

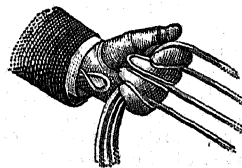


FIG. 2.

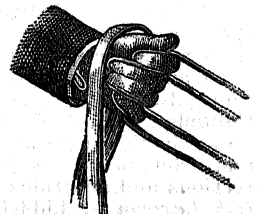


FIG. 3.

tinent and resembles the English in that the lead reins and the wheel reins each adjoin—a method also employed by professional stage-coach drivers in America. In six-horse driving the English method is practically universal (Fig.

5). The lead reins, together with those of the middle pair, are held in the same position as would be the leaders and wheelers in four-horse driving; and the reins of the wheelers are then placed on the two sides of the third finger, below

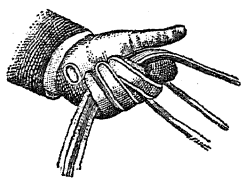


FIG. 4.

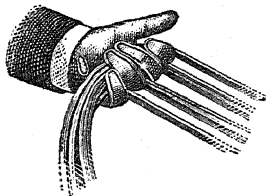


FIG. 5.

all the others. Much more easy of control and handling is the method of harnessing three abreast on the lead, with two at the wheel. Consult: Ware, *Driving* (New York, 1903); Anderson and Collier, *Riding and Driving* (ib., 1905); Beach, *Riding and Driving for Women* (ib., 1912).

**DRIVING, FURIOUS.** The offense of driving or otherwise propelling vehicles over a public road or highway at a dangerous rate of speed. Furious and reckless driving on thronged thoroughfares is an indictable offense at common law, punishable by fine and imprisonment. The offense has become statutory in England, and prosecutions are now usually brought under the statutes governing the matter, though the common-law remedy is still available. In the United States such legislation is common and has been sustained as coming within the police power of the State legislatures. In cities and incorporated villages the rate of driving and of propelling street cars, bicycles, automobiles, and other vehicles is usually regulated by municipal ordinances, having the force of legislative enactments, fixing the maximum rate of speed permitted and prescribing the penalty for a violation.

**DROBISCH, drō'bish, GUSTAV THEODOR** (1811-82). A German poet and author, born in Dresden. In 1847 he became the editor of the *Zeitung für die elegante Welt*, at Leipzig, which he conducted for 13 years. He was widely celebrated as a humorist, was editor of the *Witz- und Karrikaturen-Magazin*, and published the following contributions to humorous literature: *Amarillen und Bartnelken* (1857); *Humoristische Liedertafel* (1863); *Bunte Glasuren* (1865); *Komische Vorträge* (5th ed., 1892). He also wrote comedies, opera texts, tragedies, and novels.

**DROBISCH, MORITZ WILHELM** (1802-96). A German philosopher and mathematician. He was born and educated at Leipzig and in 1826 became professor of mathematics and philosophy at the university in that city. He began his literary career as a disciple of Herbart, and though in his later philosophical works he showed decided independence of thought, he remained Herbartian in his general attitude. He was also distinguished as a mathematician and psychologist and was especially interested in the application of mathematical laws to psychic phenomena. His philosophical writings include: *Beiträge zur Orientirung über Herbart's System der Philosophie* (1834); *Neue Darstellung der Logik nach ihren einfachsten Verhältnissen* (1886; 5th ed., 1887); *Grundlehren der Re-*

*ligionsphilosophie* (1840); *Empirische Psychologie nach naturwissenschaftlicher Methode* (1842; 2d ed., 1898); *Erste Grundlinien der mathematischen Psychologie* (1850); *Kants Dinge an sich und sein Erfahrungsbegriff* (1885). Consult Heinze, *Moritz Wilhelm Drobisch* (Leipzig, 1897).

**DROGHEDA, drōg'e-dā** (OIr. *Droicheadatha*, bridge of the ford). A seaport, municipal borough, and market town on the southern border of County Louth, Ireland, situated on both sides, but chiefly north, of the Boyne, 4 miles from its mouth, and 31 miles north of Dublin (Map: Ireland, E 3). The Dublin and Belfast Railway crosses the Boyne here by a viaduct 95 feet high. There are cotton and flax manufactures, flour mills, saw mills, tanneries, breweries, a soap factory, and an iron foundry. It has a considerable trade, chiefly with Liverpool, principally in corn, meal, flour, cattle, provisions, linen, hides, and butter. Great quantities of ale are exported. Each census since 1841 shows a falling off in the population. At that date it contained 17,300 inhabitants, while in 1891 the population numbered 13,708; in 1901, 12,760; in 1911, 12,501. Drogheda was a political and ecclesiastical centre as early as the twelfth century. Its antiquarian remains include St. Mary's Abbey, founded in the reign of Edward I, the Magdalen tower of the Dominican priory where the Irish chieftains surrendered to Richard II, the "Tholsel," or town hall, and the ruined West Gate and perfect St. Laurence Gate of the ancient fortified walls, parts of which remain. The two divisions of the town were united by a charter from Henry IV in 1412. Poyning's Laws were enacted in 1495 by a parliament assembled here. In 1649 Cromwell stormed the town and slaughtered its inhabitants. It surrendered in 1690 to William III after the battle of the Boyne, fought some 2 miles from the town. Consult Barnard, *The Siege of Drogheda* (Dublin, 1736).

**DROGIO, drō'jē-ō.** The name given by the fourteenth-century Venetian traveler Antonio Zeno to a vast country southwest of Estotiland (Labrador?). The land is probably mythical.

**DROHOBYCZ, drō'hō-bēch.** A town of Galicia, Austria, 1015 feet above sea level, situated near the left bank of the Tysmienica, a tributary of the Dniester, 40 miles south-southwest of Lemberg (Map: Austria, H 2). Its public buildings include a castle, surrounded by extensive grounds, and a handsome Gothic parish church of the fourteenth century. The chief industry is the preparation of salt from mines in the vicinity. Trade is carried on in grain, cattle, leather, paraffin, and petroleum. Pop. (commune), 1900, 19,146; 1910, 34,665.

**DROIT D'AUBAINE, drwā dō'bān'** (Fr., alien's law, Lat. *alibi nati*). A harsh rule of French law whereby all the property, real and personal, of an alien dying in France was confiscated to the crown. The rule was limited to property found within the jurisdiction of the crown and to foreigners who were domiciled within the territories of the French King. It had no application to travelers, foreign merchants trading in France but not residing there, nor to the representatives of foreign Powers. A few foreign nationalities, as the Swiss, Savoyards, Scotch, and Portuguese, were also exempted. It survived until 1819, when it was finally abolished. For the status of aliens generally, see ALIEN; CITIZEN; SUBJECT.

**DROITWICH**, droi'tich (OF., Fr. *droit*, right, customs duty + Eng. *wich*, *wick*, salt spring, Icel. *vik*, creek, Lat. *salinæ*, salt springs). A municipal borough in Worcestershire, England, 5½ miles north-northeast of Worcester, in the narrow valley of the Salwarpe, and on a canal connected with the Severn, which admits vessels of 60 tons (Map: England, D 4). It has direct communication, also, by means of other canals, with Birmingham and London and the intermediate district. Its chief trade is in salt, for which it has been famous from remote times. In the middle of the town, rising from a depth of 170 feet through beds of new red sandstone and gypsum, are the celebrated *wyches*, or brine springs, containing between 35 and 40 per cent of pure salt and yielding annually over 100,000 tons of salt, a large part of which is exported to foreign countries. The constant pumping of the brine causes the land to settle, which affects building foundations. The saline baths are much frequented. The town owns its gas and water supplies, but for many years has permitted the investment of nonlocal capital in the brine springs. Pop., 1901, 4201; 1911, 4146. The remains of a Roman villa, with tessellated pavements, etc., were found here.

**DRÔME**, drôm. A department in the southeastern part of France, bounded on the west by the Rhône (Map: France, S., K 4). Area, 2532 square miles; pop., 1901, 297,321; 1911, 290,894. Towards the east the surface is hilly, a spur of the Alps traversing the eastern limits and sending offshoots of about 3500 feet in average height westward across almost the entire area of Drôme. These heights, covered with forests of pine, oak, and beech, afford excellent pasturage in summer and autumn. The most notable rivers are the Drôme, from which the department takes its name, the Aygues, and the Isère. Vines and mulberry, chestnut, walnut, and olive trees are extensively grown. Commerce in wood, cattle, wines, and meal is carried on. In the production of mulberry leaves and in silkworm culture Drôme is one of the leading departments of France. Iron ore is abundant. The manufactures consist chiefly of woolen cloth, silk, hosiery, serge, cotton yarn, shoes, lumber, and machinery. Capital, Valence.

**DROMEDARY**, drôm'ê-dâ-rî (OF. *drome-daire*, Lat. *dromedarius*, from Lat. *dromas*, Gk. *δρῶμας*, *dromas*, a running, from *δραμεῖν*, *dramein*, to run). A name sometimes given to the Arabian, or one-humped, camel (*Camelus dromedarius*), but properly belonging to a variety of that species distinguished by slenderness of limbs and symmetry of form and by extraordinary fleetness, "bearing much the same relation to the ordinary camel as a race horse or hunter does to a cart horse." A good one is valued in Upper Egypt at from \$50 to \$75. The pace of the dromedary is a trot, which it can maintain for a prodigious length of time, often at the rate of 9 miles an hour for many hours together; while a journey of upward of 600 miles is performed at a somewhat slower rate in five days. Even its more rapid pace can be maintained for 24 hours at a stretch without sign of weariness and without stopping to bait; and if then it is allowed a little refreshment, of a ball of paste made of barley and powdered dates and a little water or camel's milk, it will resume its journey and go on with undiminished speed for 24 hours more. The jolting to the rider is terrible. The gallop is a pace unsuitable to the dromedary and

at which it very soon fails. See CAMEL, and Plate of CAMELS AND LLAMAS.

**DROMIO OF EPH'ESUS** and **DROMIO OF SYR'ACUSE**. In Shakespeare's *Comedy of Errors*, twin brothers who had been separated in childhood and, at the opening of the play, have become attendants, respectively, of Antipholus of Ephesus and Antipholus of Syracuse. The first named is thick-witted, the second is bright.

**DRONE**. See BEE.

**DRONE** (of a bagpipe). See BAGPIPE.

**DRONE FLY** (so called from its resemblance to a drone). A common cosmopolitan fly of the family Syrphidæ (*Eristalis tenax*). Its larvæ live in liquid filth and the putrefying carcasses of animals, breathing by means of a very elongated anal projection bearing spiracles at the tip; they are sometimes called "rat-tailed maggots." The fly somewhat resembles the honeybee, and this resemblance has given rise to the "Bugonia myth," which is found among many nations and is of ancient origin (Judg. xiv. 8), to the effect that honeybees may be born from filth or decaying bodies.

**DRON'GO** (Neo-Lat. *drongus*, from the Malagasy name), or **DRONGO SHRIKE**. A bird of the passerine family Dicuridæ, which is widely scattered throughout Africa and southeastern Asia and whose systematic position is undecided. The beak is very shrike-like, and beset with bristles at the base, in conformity with the insect-eating habits of the family. The plumage is invariably glossy black; the tail has 10 feathers, is forked, and the outer rectrices are often greatly prolonged, or curled or racket-shaped. These birds are wholly arboreal, active on the wing, restless and pugnacious, and nest in trees. Several genera and many species are recognized. Most of them inhabit India and Malaysia, but two species are natives of South Africa and one of Australia. See KING CROW.

**DRONGO CUCKOO**. An East Indian cuckoo (*Surniculus lugubris*), remarkable for so resembling the common drongo, or king crow (see DRONGO), as to deceive any but a careful observer. This instance of "mimicry" among birds is carried to the extent of imitating the forked tail, "a feature elsewhere entirely unexampled among the cuckoos." Ornithologists are of the opinion that this cuckoo, which is parasitic, selects the nest of the drongo, alone, as the receptacle for its egg. Several other species exhibit similar tendencies.

**DRONTE**. See DODO.

**DRONTHEIM**, drönt'hîm. See TRONDHEIM.

**DROOD**, EDWIN. See MYSTERY OF EDWIN DROOD.

**DROOGENBROECK**, drô'gen-brôök, JAN VAN (1835-1902). A Flemish poet whose pseudonym was JAN FERGUUT. He was born at Saint-Amands on the Scheldt and was educated at Lierre. He was for more than 22 years tutor and professor at a music school of Brussels. As a poet, he was the first to introduce Oriental verse forms into Dutch poetry, among his best productions of this kind being the celebrated *Makamen en Ghazelen* (1866; 2d ed., 1887). In 1886 he received a prize at Brussels for the treatise entitled *De toepassing van het Grieksche en Latijnsche metrum op de Nederlandsche Poëzie*. His poems of childhood, entitled *Dit zijn Zonnestralen* (1873; 6th ed., 1884), are popular. He also wrote the libretto to Lortzing's opera *Undine* (first performed in 1862).

**DROPSY** (bv aphæresis, for the older form

*hydropsy*, Lat. *hydropisis*, Gk. ὑδρωπῖσις, *hydropīsis*, ὑδρωψ, *hydrōps*, dropsy, from ὑδωρ, *hydōr*, water). A symptom occurring in several diseases. It consists of the effusion of watery fluid from the blood into the skin and subjacent tissues or into the cavities of the body. When the effusion is chiefly in the superficial parts and over the whole body, the dropsy is called *anasarca*; when it is in the peritoneal cavity of the abdomen, it is termed *ascites*; when in the chest, *hydrothorax*. Dropsy most commonly depends on disease of the heart (q.v.) or kidneys (q.v.) or upon the condition of the blood. Ascites is often caused by pressure upon the portal veins caused by a contracting liver, in a case of cirrhosis of that organ. The treatment of dropsy is chiefly by diuretics, diaphoretics, and cathartics, which remove the fluid from the tissues by unloading the blood of serum. In all cases of dropsy the internal organs should be submitted to a strict medical examination, and the treatment regulated accordingly. The fluid which is poured into the cavity of the pleura in pleurisy is not dropsical, but is an exudation of plastic material from the blood which has the property of becoming organized and forming adhesions between the lungs and the sides of the chest. In hydrothorax the fluid has no power of organization, although it contains blood serum. The presence of cysts in an ovary is called *ovarian dropsy*. Dropsy of the pericardium is called *hydropericardium*; of the cavity of a joint, *hydrops articuli*, or *hydrarthrosis*; of the cavity of the scrotum, *hydrocele*; of the skin and areolar tissue, *œdema*. If the cerebrospinal fluid be increased, the condition is called *hydrocephalus*. When internal medicines fail to remove an accumulation of dropsical fluid, or when it is due to pressure which cannot be relieved, it often becomes necessary to evacuate the fluid by tapping—i.e., by making an incision, or thrusting a hollow needle or trochar, into the cavity and drawing off the fluid. This operation, under antiseptic precautions, is practically free from danger and may be repeated from time to time by the surgeon as the pressure or weight of the accumulation becomes excessive. Dropsy of a limb is sometimes relieved by making several punctures through the skin. See **ŒDEMA**.

**DROPWORT**. See **SPIRÆA**.

**DROSERA**. See **SUNDEW**.

**DROSINIS**, drō-sē'nīs, GEORGE (1859– ). A modern Greek writer. He was born at Athens and, although originally a lawyer, later devoted himself entirely to belles-lettres. He lived in Germany from 1886 to 1888, during which time he edited *Erria* (*Hestia*), in which he translated several of his chief productions. His works, which are characterized by simplicity of language and genuine feeling, include five collections of lyrical poetry: *Spun Webs* (1880), *Stalactites* (1881), *Idylls* (1885), *Prince's Feathers* (1890), and *Light of Love* (1894); and the following prose writings: *Rural Letters* (1882), *Three Days in Tinos* (1885), *Tales and Reminiscences* (1886), and *Fables* (1889).

**DROSOMETER** (from Gk. δρόσος, *drosos*, dew + μέτρον, *metron*, measure). An apparatus for measuring the quantity of dew formed per unit area. The surface may be either a horizontal metal plate or a leaf hanging naturally, or a bit of wool or cotton representing a large surface of fine fibres. The measurement for a

given night should be made in the early morning, before the rising sun evaporates the dew. When the apparatus is made self-registering, the surface, with its accumulating dew, hangs at one end of a delicate balance or from a delicate spiral metallic spring and by its gradual sinking moves the index that makes the record on a moving sheet of paper. Although many forms have been suggested, yet none are found to give results that are comparable with each other from day to day, owing largely to the fact that the slightest change in the surface that receives the moisture alters the quantity of dew that is caught. Even the same bit of wool, when used day after day, changes its nature in this respect. If a metallic surface is used, its behavior must be compared frequently with a standard, partly because different metals have different properties, but principally because the same surface, when it becomes greasy, dirty, or scratched, has different properties. Many peculiarities of the deposition of dew on different objects are explained in detail in the popular work by Charles Tomlinson, entitled *The Dew-Drop and the Mist* (London, 1860). Moreover, the case of the natural deposition of dew on the grass and other plants very near the surface of the ground is not at all parallel to that where it is deposited upon metal plates or other bodies used as drosometers, partly because of the location, partly because of the difference in the substances, and largely because of the influence of slight local currents of air.

**DROSTE-HÜLSHOFF**, drō'ste-huls'hōf, ANNETTE ELIZABETH, BARONESS VON (1797–1848). A distinguished German lyric poet. She was born in the family castle of Hülshoff, near Münster, passed her life largely in seclusion, and died in the castle of Meersburg, on Lake Constance. Her *Gedichte* (1837; new ed., 1895), not numerous, are excellent in technique and gracefully sweet in character, particularly in their pictures of nature. In lyric and narrative forms they are well-nigh equally successful. Her poems appeal to the refined and thoughtful rather than to the ordinary reader. She is related artistically to Möricke, but she is more virile. Selections from them find place in most general collections of German verse. The posthumously printed *Das geistliche Jahr* (1852; new ed., 1883) consists largely of religious poems. She was an ardent Catholic. Her collected works, including the *Letzte Gaben* (1860), in which her splendid prose tale *Die Judenbuche* was printed, appeared in 3 vols. in 1878–79. Consult Schücking, *Annette von Droste-Hülshoff* (Hanover, 1871), and Busse, *Annette von Droste-Hülshoff* (Bielefeld, 1903).

**DROUAIS**, drō'ā'. A French family of artists.—HUBERT (1699–1767) was best known as a miniature painter. He was born at La Roque and studied at Rouen and under De Troy in Paris. His miniatures are principally in private collections, but there are two portraits by him in the Louvre—one of the painter Christophe, and the other of the sculptor Robert le Lorrain. He assisted Nattier and Van Loo in the execution of costumes and accessories, and was appointed court painter in 1744.—His son and pupil, FRANÇOIS HUBERT (1727–75), the most important member of the family, studied also under Van Loo, Natoire, and Boucher. It was the fashion to be painted by François at the time of Louis XV, and he has left many portraits, especially of women and

children, charmingly executed in the graceful, delicate, and rather weak style of the age. Among those who sat for him were Madame de Pompadour, Madame du Barry (as a muse, a huntress, and as Flora), Marie Antoinette as Hebe, and Mademoiselle Helvetius (Morgan collection, Metropolitan Museum, New York). There are also four portraits in the Louvre and many in private collections. François Drouais was court painter and councilor of the Academy. The most characteristic of his pictures is "A Child Playing with a Cat" (1765).—GERMAIN JEAN (1763–88) was the son of François. He was born in Paris and studied under his father, Frenet, and David, whose favorite pupil he was. In 1784 he won the Roman prize with his picture "Christ and the Canaanite Woman" (Louvre) and went with David to Rome, but he died there three years later. "Marius at Minturnas" (Louvre) and the "Dying Gladiator" (Rouen Museum), both painted during his stay in Rome, reveal Germain Jean as a beginner of much promise. He painted in the style of David, but with more sentiment. Consult Gabillet, "Les trois Drouais," in *Gazette des Beaux-Arts* (Paris, 1905–06).

**DROUET**, drōō'ā, JEAN BAPTISTE, COUNT D'ERLON (1765–1844). A marshal of France. He was born July 29, 1765, at Rheims, and entered the army as a private in 1782, took part in the campaigns of 1793–96, and became aid-de-camp to General Lefèvre. He distinguished himself during the sieges of Valenciennes, Le Quesnoy, and Condé, and in 1797, under Hoche, forced the surrender of the fortress of Ehrenbreitstein. His important services caused his rapid promotion, and he became brigadier general in 1799. Made a general of division in 1800, he took an active part in the campaign of 1805–07, distinguished himself at Jena and being wounded.

His conduct won him the Grand Cross of the Legion of Honor and the title of Comte d'Erlon. He took a prominent part in the Peninsular War, and fought bravely against Wellington in 1814. After the fall of Napoleon he was given command of the Sixteenth Division, but was shortly afterward arrested on the charge of conspiring against Louis XVIII. He managed to escape upon the approach of Napoleon, and, putting himself at the head of the troops, he seized the citadel and held it for the Emperor, who made him a peer of France. In the Waterloo campaign Drouet commanded the First Army Corps, but, misunderstanding the Emperor's orders, wasted valuable time in a fruitless march between Ligny and Quatre-Bras. After the capitulation of Paris he fled to Bavaria, where he resided until 1825, when he returned to France. He received, in 1830, the command of the Twelfth Military District, with headquarters at Nantes, where he put down the Legitimist rising in La Vendée and arrested the Duchesse de Berry. During 1834–35 he held the important office of Governor-General of Algeria and in 1843 was elevated to the rank of marshal. He died Jan. 25, 1844. Consult *Notice sur la vie militaire du maréchal Drouet, écrite par lui-même* (Paris, 1844), and Sloane, *Life of Napoleon* (New York, 1896).

**DROUOT**, drōō'ō, ANTOINE, COUNT (1774–1847). A French general, born at Nancy. He fought at Fleurus (1794) and Hohenlinden (1800) and greatly distinguished himself by his skill and valor at Wagram. On the retreat from Moscow he displayed extraordinary energy

and fertility of resource. One of his most brilliant exploits was performed at Hanau, where his desperate assault on the Bavarian army enabled the French to make good their retreat to the Rhine. He accompanied Napoleon to Elba as Governor of the island and subsequently fought at Waterloo. He enjoyed wide renown as an artilleryman, and his sound judgment secured for him the title of "Sage of the Grand Army."

**DROUYN DE LHUYS**, drōō'ān' de lwēs', EDOUARD (1805–81). A French diplomatist and politician. He was born in Paris, Nov. 19, 1805, and received a thorough classical and legal education at the Lycée Louis-le-Grand and the Ecole de Droit. In 1831 he was attached to the Embassy at Madrid. As chargé d'affaires at The Hague (1833–36), and thereafter as First Secretary of the Embassy at Madrid, he showed his diplomatic ability. In 1840 he was placed at the head of the Bureau de Commerce, under the Minister of Foreign Affairs, and in 1842 was elected deputy from Melun; but, having voted against the government, he was deprived of his administrative office by M. Guizot in 1845. He thereupon became a bitter opponent of the statesman and signed the act of accusation of the Guizot ministry drawn up by Odilon Barrot, Feb. 22, 1848. After the overthrow of Louis Philippe he was elected representative to the Constituent Assembly from the Department of Seine-et-Marne and became president of the Committee on Foreign Affairs. In the first cabinet formed by Louis Napoleon, after his election to the presidency in December, 1848, Drouyn de Lhuys became Minister of Foreign Affairs. In 1849 he went to London for a short time as Ambassador, and early in 1851 again became Minister of Foreign Affairs. After the coup d'état of Dec. 2, 1851, he became one of the vice presidents of the Senate, and in July, 1852, he was for the third time made Minister of Foreign Affairs. During this time he directed the negotiations relative to French participation in the Crimean War. Disappointed at the issue of the Vienna conferences in 1855, he resigned his office. In 1862 he was recalled, but resigned in 1866. On the fall of the Empire he fled to Jersey, but after a year returned to France and lived in retirement until his death, March 1, 1881. He was the author of a work entitled *Les neutres pendant la guerre d'Orient* (Paris, 1868). Consult Comte d'Harcourt, *Diplomatie et diplomates: les quatre ministères de M. Drouyn de Lhuys* (Paris, 1882); also his *Mémoires*, inserted in the collections of the French Academy of Moral and Political Sciences.

**DROWN**, THOMAS MESSINGER (1842–1904). An American chemist and metallurgist. After a course of study at the best scientific schools in the United States and at two European universities he was appointed instructor in metallurgy at Harvard and later professor of analytical chemistry at Lafayette College. From 1885 to 1895 he held the same chair at the Massachusetts Institute of Technology. In 1895 he became president of Lehigh University. He served as president of the American Institute of Mining Engineers in 1897.

**DROWNING**. See ASPHYXIA; RESUSCITATION.

**DROWNING** (from *drown*, from AS. *drucn*, *drucn*, Icel. *drucna*, OHG. *truncan*, *drucn*, *drucn*, to drown, from AS. *drucen*, p.p. of *drucan*,



Icel. *drekkja*, OHG. *trinchān*, Ger. *trinken*, to drink). A form of capital punishment once common throughout Europe, but now obsolete among the nations of Christendom, though it is still practiced in Mohammedan countries and in the Far East. Tacitus, writing about the end of the first century, tells us that the Germans hanged their greater criminals, but that meaner offenders were plunged under hurdles into bogs and fens. By the law of the ancient Burgundians a faithless wife was condemned to be smothered in mud. The Anglo-Saxon codes ordered women convicted of theft to be drowned. The punishment was in such common use in the Middle Ages that grants of capital punishment ran *cum fossa et furca*, i.e., 'with pit and gallows.' The pit, ditch, or well was for drowning women; but the punishment was occasionally inflicted on men, perhaps because less cruel and revolting than other forms of capital punishment, as a matter of favor. Thus, in Scotland, in 1556, a man convicted of theft and sacrilege was sentenced to be drowned "by the Queen's special grace." So late as 1611 a man was drowned at Edinburgh for stealing a lamb. By that time the punishment of drowning had become obsolete in England. It survived in Scotland until 1685. The last execution by drowning in Switzerland took place in 1652, in Austria in 1776, in Iceland in 1777. It was abolished in Russia early in the 19th century. It has never been practiced in the United States. See CAPITAL PUNISHMENT; PUNISHMENT, and the authorities there referred to.

**DROYSEN**, *droi'zen*, JOHANN GUSTAV (1808-84). A German historian, born at Treptow. He studied in Berlin and became privatdocent there in 1833 and professor extraordinary in 1835. In 1840 he accepted a call to the University of Kiel, and thenceforth took a prominent part in the Schleswig-Holstein dispute with Denmark as an upholder of the German claims. Sent as a representative from Kiel to the Diet of Frankfort, he was subsequently a member of the Frankfort Parliament. In 1851 he was appointed professor of history at Jena, where he founded the historical seminar, and in 1859 was called again to Berlin, where he achieved a reputation as one of the greatest German historians of the century. He died in Berlin. Of his numerous works, the following are the most important: *Geschichte Alexanders des Grossen* (Berlin, 1833); *Geschichte des Hellenismus* (Hamburg, 1836-42); *Geschichte der preussischen Politik* (14 vols., Leipzig, 1855-86); *Grundzüge der Historik* (Leipzig, 1876). For his life, consult, Duncker, *Johann Gustav Droysen* (Berlin, 1885), and a biographical sketch by Kruger in his *Outlines of the Principles of History*, trans. by E. B. Andrews (Boston, 1893).

**DROZ**, *drô*, FRANÇOIS XAVIER JOSEPH (1773-1850). A French moralist and historian. He served for some years in the army, but afterward was appointed to the chair of oratory at the Ecole Centrale de Besançon. He soon attracted attention as a writer on philosophical subjects and especially as the author of an *Essai sur l'art d'être heureux* (1801). His *Philosophie morale* (1823) gave him a place in the Academy. His greatest work is *L'Histoire du règne de Louis XVI pendant les années où l'on pouvait prévoir et diriger la révolution française* (3 vols., 1839-42). His other works include: *Sur le droit politique* (1802); *Appli-*

*cation de la morale à la politique* (1825); *Economie politique* (1829).

**DROZ**, GUSTAV (1832-95). A minor French novelist and humorist, who catches the tone of the society of the Second Empire, toying with amiable vices, as the eighteenth century did with the pastoral virtues. His best novel is *Autour d'une source* (1869). His most successful and characteristic book, *Monsieur, Madame et Bébé* (1866), was the first to attract notice.

**DROZ**, NUMA (1844-99). A Swiss statesman, born at La Chaux-de-Fonds. He worked as an engraver, educated himself to be a school teacher, and in 1864 became editor of the radical journal *National Suisse*. In 1868 he was chosen a member of the Council of Neuchâtel, and in 1871 he conducted the religious and educational interests of the canton. In 1875 he became a member of the Federal Council and Minister of the Department of the Interior in 1875 and took the portfolio of Commerce and Agriculture in 1879. He was elected President of the Swiss Confederation in 1881 and again in 1887. Upon the establishment of the Bureau of International Railroad Transportation he was appointed its director (1893). His publications include: *L'Instruction civique* (2d ed., 1886); *Essais économiques* (1895); *Etudes et portraits politiques* (1895).

**DROZ**, PIERRE JACQUET (1721-90). A Swiss mechanic. He was born at La Chaux-de-Fonds and became famous as the improver of the mechanism of the watch and the inventor of a music box which reproduced the tones of various instruments, of an "automatic writer," operated by an internal mechanism, and of various other unique devices. One of his most important inventions was a self-adjusting pendulum.

**DRUDE**, *drō'de*, KARL GEORG OSKAR (1852-). A German botanist, born in Brunswick. From 1870 to 1874 he studied at Brunswick and Göttingen, and in 1879 he became professor of botany at the Polytechnical School, Dresden, and director of the botanical garden. In addition to the monograph published in collaboration with A. Engler under the title *Die Vegetation der Erde* (Leipzig, 1896 et seq.), his publications include: *Die Florenreiche der Erde* (1884); *Handbuch der Pflanzengeographie* (1890); *Deutschlands Pflanzengeographie*, vol. i (1895); *Der hercynische Florenbezirk* (1902); *Die Oekologie der Pflanzen* (1913); and valuable contributions to the publications of Martius and Berghaus.

**DRUENTIA**. The Roman name of the river now known as the Durance (q.v.).

**DRUG** (Fr. *drogue*, from Dutch *droog*, dry; being formerly supposed to dry and cleanse the body). Any substance, whether of animal, mineral, or vegetable origin, especially in its crude or commercial form, that is used as a medicine or in the preparation and composition of medicines.

**DRUG ADDICTIONS**. The principal drugs resulting in formation of habits are opium and its products (morphine, heroin, codeine, and others), cocaine, cannabis indica, alcohol, and tobacco.

The opium habit has long been practiced in the Far East and did not become popular in Europe and other western countries until some time after 1845, when the practice of injecting drugs through the hypodermic needle was introduced. Morphia was the drug used, and for a time the vice was extremely prevalent. Accord-



ing to Jouet and Zambaco, the habit became almost a fashion among the ladies of Paris and Constantinople, and hypodermic syringes of fanciful design and costly ornamentation were used and even given as presents. There were said to be 40,000 morphinomaniacs in Paris in 1883 and 100,000 in 1893, but since then the habit has greatly decreased. Extravagant figures have been quoted as to the prevalence of the morphine habit in the United States, but these are largely a matter of speculation. For the symptoms and effects of this addiction, see OPIUM.

The cocaine habit is of more recent growth. This drug was introduced into medicine 30 years ago, and its abuse has become a serious problem in Europe and America, partly through carelessness in prescribing solutions as nasal sprays, but principally from the introduction of it into patent medicines, catarrh snuffs, tonic wines, and the like. Various coca wines, vaunted as nerve tonics, serve merely as vehicles for cocaine. The cocaine habit is the most demoralizing and rapidly cultivated addiction known, since the effects of the drug wear off quickly and repeated doses are required. It is largely used by the criminal class; it seems to have a particularly debasing effect upon the mind and morals as well as the physique of the habitué, and it brings about rapidly a state of profound mental and moral degradation. Among the first effects are sleeplessness and loss of appetite, conditions which in themselves suffice to undermine the constitution. Soon there follow other manifestations: headache, lack of muscular control, symptoms of intestinal auto-intoxication, and later still delusions and hallucinations, which merge into insanity, with a tendency towards suicide. The habit is difficult to break, and comparatively few addicts ever fully recover. In South America the use of cocaine among the Indians has existed from time immemorial. Among them the habit takes the form of leaf chewing, a little alkali being mixed with the leaves. Overindulgence among these people, however, is comparatively rare.

Tea, coffee, cocoa, kola, maté, and guarana together form a group of products, widely used on account of certain stimulating principles, viz., caffeine, theobromine, theophyllin. These bodies are chemically distinct from cocaine, but as poisons they resemble it very closely. They are taken to overcome fatigue and to stimulate the cerebral functions. Prolonged abuse of the group establishes, no doubt, a certain degree of tolerance, but they all have a cumulative tendency. Tea tasters, e.g., are said to suffer from headache, noises in the ears, vertigo, sleeplessness, and impaired digestion. The excessive use of tea and coffee is known to be responsible for certain nervous disturbances, the principal features of which are instability and irritability, accompanied by sleeplessness and dyspepsia.

The effects of the moderate and excessive use of tobacco have long been a subject of debate. It is certain, however, that tobacco, while varying greatly in its action in different individuals, results in an increase in blood pressure and is therefore a factor in the production of arteriosclerosis. The heart is apt to be irregular, and poisoning of the optic nerve is occasionally observed. For further discussion of the addiction, see TOBACCO.

Chloral hydrate, paraldehyde, veronal, and

similar hypnotics are substances whose introduction as soporifics to replace opium resulted in the formation of habits in a great number of people. The ultimate effects, although somewhat slow in making themselves apparent, are not unlike those of cocaine. The addicts are, in the first place, apt to be neurotic, and any habit speedily fastens itself upon them. After a time the sleeplessness becomes worse, larger doses are required, and the patient becomes anæmic, weak, anxious, restless, and the heart action feeble and irregular. There is the usual deterioration in moral fibre, and the end is likely to be delusional insanity. Still another group of pain relievers may be mentioned. These belong to the same class as acetanilid and antipyrin and are represented by a host of popular headache remedies. Addiction to them causes a gradual decline in the general health, while the condition for which the remedy was taken becomes more pronounced. These drugs are nerve poisons, and their prolonged use induces a high degree of anæmia, cardiac weakness, abolition of the will power, and degeneration of the heart muscle. A description of the alcohol habit will be found under ALCOHOLISM and of cannabis indica addiction under HASHEESH. Consult: Sainsbury, *Drugs and the Drug Habit* (New York, 1909); C. A. McBride, *Modern Treatment of Alcoholism and Drug Narcotism* (ib., 1910); G. E. Pettey, *Narcotic Drug Diseases and Allied Ailments* (Philadelphia, 1913).

**DRUGGER, ABEL.** A gullible tobacconist in Jonson's *Alchemist*. The part was a favorite rôle of Garrick.

**DRUGGET** (Fr. *drouget*, of unknown etymology). A common felt or other coarse woollen fabric, often printed on one side and chiefly used for covering carpets or as a substitute for a carpet.

**DRUGGISTS.** See CHEMISTS AND DRUGGISTS.

**DRUID** (Lat. *druida*, Gk. *δρυῖδης*, *dryidēs*, from OIr. *drui*, nom. pl. *druid*, Gael. *draoi*, connected with OIr. *dair*, *daur*, oak, Gk. *δρῦς*, *drys*, tree, OChurch Slav. *drŭva*, Skt. *dāru*, wood). One of the fraternity of priests, religious teachers, and judges who ruled over the Celtic inhabitants of ancient Gaul, Britain, and Ireland. The institution of druidism was probably common to all Celtic nations, but we have detailed accounts of the form only under which it existed in Gaul. Cæsar gives the following description of the character and functions of the Druids: "They attend to divine worship, perform public and private sacrifices, and expound matters of religion. A great number of youths are gathered round them for the sake of education, and they enjoy the highest honor in that nation. Nearly all public and private quarrels come under their jurisdiction; and when any crime has been committed, as when a murder has been perpetrated, or when a controversy arises about a legacy or about landmarks, they are the judges too. They fix rewards and punishments; and should any one, whether a private individual or a public officer, disobey their decrees, then they exclude him from the sacrifices. This is with them the severest punishment. The persons who are thus laid under interdict are regarded as impious and wicked people; everybody recoils from them and shuns their society and conversation, lest he should be injured by associating with them. They cannot obtain legal redress when they ask for it, nor are they admitted to

any honorable office. . . . At a certain time of the year the Druids assemble in the territory of the Carnutes, which is believed to be the centre of all Gaul, in a sacred place. To that spot are gathered from everywhere all persons that have quarrels, and they abide by their judgments and decrees. It is believed that this custom was invented in Britannia and thence transplanted into Gaul. Even nowadays those who wish to become more intimately acquainted with the institution generally go to Britannia for instruction's sake.

"The Druids take no part in warfare; nor do they pay any taxes, like the rest of the people; they are exempt from military service and from all public burdens. Attracted by such rewards, many come to be instructed of their own choice, while others are sent by their parents. They are reported to learn in the school a great number of verses, so that some remain there 20 years. They think it an unhallowed thing to commit their lore to writing, though in the other public and private affairs of life they frequently make use of the Greek alphabet. . . . Beyond all things they are desirous to inspire a belief that men's souls do not perish, but transmigrate after death from one individual to another; and they hold that people are thereby most strongly urged to bravery, as the fear of death is thus destroyed."

This powerful priesthood did all they could to uphold the national cause against the Roman conquerors and urged the people to rebellion. The emperors Tiberius and Claudius found it necessary to interdict formally the practice of druidical rites, which seem, however, to have continued down to the extinction of paganism. Besides being priests and teachers of religion, the Druids appear to have been adepts in the magic arts and were versed in the mysterious powers of animals and plants. The oak tree was especially sacred among the Druids, and they frequently performed their rites in oak groves. They also had a special reverence for mistletoe when growing on an oak. According to the elder Pliny, a Druid, clothed in white, mounted the tree and with a knife of gold cut the mistletoe, which was received by another standing on the ground, on a spotless cloth. The same author gives a curious account of the "serpent's egg" worn as a distinguishing badge by the Druids. It was formed, he says, by the poisonous spittle of a great many serpents twined together. Gathered at moonlight, and afterward worn in the bosom, it was a mighty talisman. All these particulars refer properly to the Druids of Gaul, but the druidism of Britain was probably essentially the same.

In all the countries anciently inhabited by Celts there are found rude structures of stone, one of the most common forms of which is the so-called *dolmen* (q.v.). The older archaeologists assumed that these were druidical altars, but there is no proof that such was their purpose or origin. Similar structures are found in Scandinavia and Germany, and to assume in all these countries the presence of Celts seems too hazardous. The same doubts prevail as to the supposed druidical temples of Avebury, of Carnac in Brittany, and of Stonehenge (q.v.). Consult: Cæsar, *De Bello Gallico*, vi, 13, 14; Ramsay, *Foundations of England*, vol. i (London, 1894); D'Arbois Jubainville, *Introduction à l'étude de la littérature celtique*, (Paris, 1883); id., *Les Druides et les dieux celtiques à forme d'ani-*

*maux* (ib., 1906); Bonwick, *Irish Druids and Old Irish Religions* (London, 1894); Rhys, *Lectures on the Origin and Growth of Religion as Illustrated by Celtic Heathendom* (ib., 1888). See CELTIC PEOPLES.

**DRUIDS, ORDER OF.** A secret organization for purposes of mutual aid and protection, established in London in 1781, introduced in the city of New York in 1833 and in Germany in 1872. In England a number of independent lodges sprang from the parent organization; in the United States the order assumed a more national character, the first grand grove (the name "lodge" was discontinued) having been established in 1849. The society included, in 1914, 18 grand groves and 542 subgroves, with a total membership of 29,525; in the same year it had paid out in benefits \$7,833,226. Many of the members of the organization are German or of German descent.

**DRUM** (Dutch *trom*, Ger. *Trommel*, dial. *dromm*, from OHG. *trumba*, *trumpa*, trumpet, It. *tromba*, Fr. *trompe*, Eng. *trump*; connected ultimately with Lat. *triumphus*, triumph, Gk. *θρίαμβος*, *thriambos*, Bacchic procession). A musical instrument of percussion, consisting of a cylinder of wood or brass over one or both ends of which a membrane is stretched tightly by means of wooden hoops. There are four kinds of drums—the side drum, only differing from the snare drum (q.v.) in the absence of gut strings across its under side, the bass drum (q.v.), and the kettledrum (q.v.). With the exception of the last, drums cannot be perfectly tuned and hence are of use only to mark or vary the rhythm. Drums of various forms were early used in Egypt and India. An Egyptian instrument corresponding to the modern African *tom-tom* can be traced back to about 1600 B.C. The *tympanum* of the Greeks and Romans resembled a small modern kettledrum, though it could not be tuned to any exact pitch. From India the use of drums spread westward, being introduced into Europe either by the Moors or through the Crusades. See MUSICAL INSTRUMENTS.

**DRUM, IN ARCHITECTURE.** 1. Any one of the superposed cylindrical blocks of which a nonmonolithic column is composed. (See COLUMN.) 2. The circular or polygonal structure on which domes are often carried, raising them high above the surrounding structure. The drum was developed from the crown of buttressed windows of Hagia Sophia and similar Byzantine domes. It occurs chiefly in late Byzantine and in Renaissance domes, as in St. Peter's at Rome, but is seen also in many Mohammedan domes. See DOME; MOHAMMEDAN ART.

**DRUM, or DRUMFISH** (so called from the drumming noise). Any of several fishes of the family *Sciænidae*, most of the species of which make a noise under water variously called croaking, drumming, snoring, grunting, etc., but which most resembles the roll of a muffled or distant drum. This noise is commonly thought to be produced by the transfer of air to different compartments of the air bladder. The fishermen frequently attribute it to the rubbing together of the broad pharyngeal teeth, which are arranged like a cobblestone pavement and are often preserved as a seashore curiosity. These remarks more particularly apply to the salt-water drum of the Atlantic coast of the United States (*Pogonias chromis*), which has been known to exceed 100 pounds in weight, but ordi-

narly is less than 50. It is a heavily built fish, with poor flesh, large scales arranged in diagonal rows, and a large number of short barbels hanging from the lower jaw. In search of the mollusks upon which it mainly feeds it frequents bays and shallow coastal waters, and may often be heard at night "drumming" steadily for a long time beneath an anchored boat. It is a great pest to the oyster planters about New York, destroying annually a vast amount of cultivated oysters, the fish crushing into fragments hundreds more than it eats. (Consult, on this point, Ingersoll, "The Oyster Industry," in *United States Tenth Census Report*, Washington, 1881.) This species ranges on the east coast south to Uruguay. The southern variety (*Pogonias curbina*) is known by the Brazilians as curbina, meaning "croaker." The fresh-water or river drum (*Aplidnotus grunniens*), also known as thumpumper, sheepshead, and croaker, is a kindred fish, common in the lakes and streams of the Mississippi valley. In the North it is not much valued, but in the South it ranks high as a food fish. Other species of drum are the red drum (*Sciaenops ocellatus*) of the South Atlantic and Gulf States, and the black drums of the genus *Sciana*, mostly of the Old World. Most of the species afford good sport with the line.

**DRUMCLOG**, drüm-klög' (Gael., ridge of stone). A tract of moorland in Lanarkshire, Scotland, famous as the place where 200 Camerorians defeated Claverhouse on June 11, 1679 (Map: Scotland, D 4). An obelisk commemorates the victory. The battle is graphically described in Scott's *Old Mortality*.

**DRUMLIN** (from Ir., Gael., *druim*, drum, ridge). A smoothly arched oval hill rarely more than 150 feet high or more than  $\frac{1}{2}$  mile long, usually occurring on the flat lowlands, and looking somewhat like a sand dune, but made of coarser materials and covered with thin soil and vegetation. Drumlins are composed of till, as it is called in Scotland, or the hardpan or boulder clay of northern New England, that has been heaped up by the pressure of overlying glaciers. They have steep convex sides and are elongated in the direction of an ice flow, i.e., usually from north to south. Drumlins occur in all glaciated districts, and their existence in New England, New York, and the lake region of North America indicates that all of that country has been once covered with glaciers, or rather with a single continuous glacial covering. Drumlins are found over all that portion of North America, Europe, and Asia that lies north of the terminal moraine of the continental glacier. See GLACIER; GLACIAL PERIOD.

**DRUM MAJOR**. The noncommissioned officer in charge of a drum corps or band. In the United States army he is appointed by the regimental commanders upon the recommendation of regimental adjutants. He ranks with first sergeants, receiving pay at the rate of from \$36 to \$60 per month according to length of service. Under the supervision of the regimental adjutant he has charge of the interior discipline and administration of the band. At all formations of the band he leads and controls its movements. The chief musician, pay from \$75 to \$99, has charge of the musical instruction of the band as distinguished from its military instruction. In the English service, since 1878, the drum major has been called the sergeant drummer.

**DRUMMER**. In the United States army there is no official grade of drummer. However, a drum and fife corps is sometimes organized by the regimental commander. For this purpose he usually details the two trumpeters of each troop, the three musicians of each battery or the two musicians of each company, and other privates, to take the necessary instruction and drill under the drum major. Trumpeters and musicians have the rank and pay of privates. In the United States and British army they act as *musici* in the daily routine of barrack and camp life, and are called by bugle or drum the various duties of the day.

**DRUMMOND, GEORGE**. See PERTH, EARL OF. **DRUMMOND, SIR GORDON** (1772-1854). A British soldier, born in Quebec. He became an ensign in the Royal Scots in 1789, was rapidly promoted, and in 1794 attained the rank of lieutenant colonel of the King's Liverpool Regiment, which he commanded in several campaigns on the Continent, particularly distinguishing himself at the battle of Nimeguen. He served in the Egyptian campaigns of 1800-01, commanded a division in Jamaica from 1805 to 1807, and in 1810, with the rank of lieutenant general, was second in command to Sir George Prevost, commander of the forces in Canada. He took part in the American War of 1812, commanding the British at the indecisive battle of Lundy's Lane, or Bridgewater, on July 25, 1814, and remained in Canada as commander in chief of the British forces after the close of the war, until 1816. He was promoted to the rank of general in 1825 and made G.C.B. in 1837.

**DRUMMOND, HENRY** (1851-97). An English author and minister of the Free church, born in Stirling, Scotland. From the high school of Stirling and a boarding school in Crieff he passed to the University of Edinburgh (1866). Four years later he began his preparation for the ministry at New College, Edinburgh. Stirred by the preaching of Moody, he engaged in active mission work (1873-75); in 1877 he was appointed lecturer on natural science in the Free Church of Glasgow, and in 1884 became professor of natural science.

He now began missionary work among college students with very great success. The "Free Church" movement he initiated spread to the English-speaking world, and he was called to America and Australia. In the interest of science he also made expeditions to the Rocky Mountains and to South Africa. The aim of Drummond was to reconcile science and religion. To this end he wrote *Natural Law in the Spiritual World* (1883) and *The Ascent of Man* (1894). He also published *Tropical Africa* (1888); *Travel Sketches* (1890); and other books and addresses, among which is *The Greatest Thing in the World* (1890). Drummond's books were widely read and made a deep impression, at least upon amateurs in science. For biography, consult George Adam Smith, *Life of Drummond* (1902), and lives by Lennox (New York, 1901) and Simpson (ib., 1901).

**DRUMMOND, JAMES** (1835- ). An English Unitarian theologian. He was born in Dublin, the son of a clergyman, William Hamilton Drummond, who translated Lucretius. He graduated at Trinity College, Dublin, in 1855; studied theology at Manchester New College, in 1859-69 was minister of the Cross Street Unitarian Chapel, Manchester, and then became professor of theology in Manchester New College, where he succeeded James Martineau as principal.

pal in 1885. He retired from this post in 1906. His principal works, apart from New Testament commentaries, deal with the period immediately before the New Testament and its influence on apostolic thought. They include: *The Jewish Messiah* (1877); *Introduction to Theology* (1884); *Philo-Judeus* (1888), probably the most valuable book in English on Jewish Alexandrian philosophy; commentaries on Galatians (1893) and Thessalonians (1899); *Via, Veritas, Vita* (1894, Hibbert Lectures); *Some Thoughts on Christology* (1902); *Life and Letters of James Martineau* (1902, with Upton); *The Character and Authorship of the Fourth Gospel* (1904); *Johannine Thoughts* (1909); *Paul: His Life and Teaching* (1911).

**DRUMMOND, THOMAS** (1797-1840). A Scottish engineer. He was born at Edinburgh, was educated at the Royal Military Academy, Woolwich, and in 1815 entered the Royal Engineers. In 1820 he was engaged by Colonel Colby to assist in the trigonometrical survey of the United Kingdom. The incandescence of lime having been brought under his notice at a lecture on chemistry, the idea occurred to him that it might be advantageously used on the survey to render distant objects visible. He accordingly made experiments, which resulted in the introduction of the limelight (Drummond light). A heliostat (q.v.) of his invention was also used extensively. He was head of the commission appointed to readjust the borough boundaries under the provisions of the Reform Bill of 1832 and in 1835 became Undersecretary of State for Ireland.

**DRUMMOND, WILLIAM** (1585-1649). A Scottish poet, descended from a very ancient and noble family and born at the family seat, Hawthornden, near Edinburgh. He was educated at the high school of Edinburgh and at the university of that city, where he took his degree of A.M. in 1605. During 1607-08 he was on the Continent, attending law lectures in Bourges and Paris. He returned in 1609 and in the following year went to Hawthornden, which, according to the learned Ruddiman, "was a sweet and solitary seat, and very fit and proper for the muses," and there spent his life in his favorite literary pursuits. Drummond enjoyed the friendship of many literary men, and the record of a famous visit of Ben Jonson to Hawthornden, in the winter of 1618-19, has been preserved in Drummond's *Notes of Ben Jonson's Conversation with William Drummond*. His verse, written in the standard English dialect, comprises an elegy on the death of Prince Henry, son of James I, entitled *Tears on the Death of Meliades* (1613); *Poems* (1616), in which are some of his choicest pieces; and *Fourth Feasting* (1617), in honor of James I's visit to Scotland. Drummond had a rare command over difficult metres, and many of his sonnets and madrigals are very beautiful. A *Cypress Grove* (1623), an essay on death, is a remarkable piece of prose. He also wrote political tracts, and a history of Scotland from 1424 to 1542. His *Poems*, ed. with memoir, by W. C. Ward, were published in 2 vols. (London, 1894; New York, 1905). For his *Life*, consult Masson (ib., 1873). A later edition of his poems is *Poetical Works*, ed. L. E. Kastner (2 vols., University of Manchester, and New York, 1913).

**DRUMMOND, SIR WILLIAM** (1770-1828). An English diplomat and writer. In 1796 and 1801 he was a member of Parliament and at

different times was sent on diplomatic missions to Naples and Constantinople. His writings include: *A Review of the Government of Sparta and Athens* (1795); *Origines* (1824-29); and the *Edipus Judaicus* (1811), notable for its ingenuity in explaining Old Testament stories as astronomical allegories.

**DRUMMOND, WILLIAM HENRY** (1854-1907). A Canadian poet. He was born in County Leitrim, Ireland, but in early youth came to Canada. He was educated at the English high school and McGill University, Montreal, and in 1884 ' ' ' ' in medicine at the University of Bishc ' ' ' ' Lennoxville, P. Q., in which he afterward became professor of medical jurisprudence. He began professional practice in a little community made up of Indians, half-breeds, French *habitants*, Scotch-Irish Canadians, and English, and affording unusual opportunities for observing character. He soon removed to Montreal, where he continued to practice until his death. Fond of sport, he learned wood lore and enjoyed forest and camp life, chiefly with the French-Canadians, whom he afterward portrayed. In his poetry the *habitant* was made to speak in broken English so naturally that the insight, pathos, and humor are heightened rather than obscured by the oddities of dialect and idiom. His Irish-dialect and English poems are not equal in merit to his poems of the *habitant*. His publications are: *The Habitant and Other French-Canadian Poems* (1897); *Phil-o-rum's Canoe and Madeleine Vercheres* (1898); *Johnnie Courteau and Other Poems* (1901); *The Voyageur and Other Poems* (1905); *The Great Fight* (1908). *The Poetical Works of William Henry Drummond*, with an introduction by Louis Fréchette and an appreciation by Neil Munro, was published in 1912. Consult "English-Canadian Literature," in *Canada and its Provinces*, vol. vi (Toronto, 1914).

**DRUMMOND ISLAND.** An island forming a part of Chippewa Co., Mich. (Map: Michigan, K 3). It lies in Lake Huron and is the most westerly of the Manitoulin group, being about 30 miles east of Mackinaw. It is 20 miles long and 10 miles wide at the widest place.

**DRUMMOND LIGHT, CALCIUM LIGHT, or LIMELIGHT.** The intense brilliant light that is produced when an oxyhydrogen flame is directed against lime. The light was invented by Capt. Thomas Drummond (q.v.). In the production of the light minute portions of the lime become volatilized by the intense heat. The cylinder of lime must therefore be kept slowly rotating by means of clockwork, so that a new surface may be continually presented to the flame. Ordinary illuminating gas is often substituted for the hydrogen, the oxygen being supplied to the gas flame in a highly compressed state. Magnesia, zirconia, and other earths have the similar property of being volatilized when heated. The Drummond light, and the light obtained by strongly heating other metallic oxides than that of calcium, are employed in magic lanterns, in photography, etc. The Drummond light has now been superseded by the electric arc light.

**DRUMMONSSEE MOOR.** See CULLODEN.

**DRUMONT, dru'môn',** EDOUARD ADOLPHE (1844- ). A French anti-Semitic agitator and journalist, born at Paris. He was at first in the government service, but later became a contributor to the press and was the author of a

number of miscellaneous works, of which *Mon vieux Paris* (1879) was crowned by the Academy. In 1886 he began a violent campaign against the Jews in his book *La France juive devant l'opinion*. This was followed by *La fin d'un monde* (1888); *Dernière bataille* (1890); *Testament d'un antisémite* (1891); *Secret de fourmies* (1892); *De l'or de la boue du sang* (1896), dealing with the Panama scandals; *Les Juifs et l'affaire Dreyfus* (1899); *Vieux portraits, vieux cadres* (1900). In 1892 he founded the *Libre Parole* as an organ for his views. From 1898 to 1902 he represented Algiers in the Chamber of Deputies. Consult Stéphane Arnoulin, *M. Edouard Drumont et les Jésuites* (Paris, 1902).

**DRUNKENNESS** (AS. *druncness*, from *druncen*, p.p. of *drincan*, Icel. *drekka*, Goth. *drigkan*, OHG, *trinkan*, Ger. *trinken*, to drink). The mental and physical condition resulting from excessive drinking of intoxicating liquors. Its effect upon the contractual capacity of its victim is the same as that of insanity, though in Lord Coke's time intoxication was no ground for avoiding a contract. "As for a drunkard," he declares, "who is *voluntarius dæmon*, he hath no privilege thereby." It is now settled, in accordance with the dictates of good sense and common justice, that a contract made by a person so destitute of reason as not to know the consequences of his agreement, though his incompetency be produced by voluntary drunkenness, is voidable at his option.

Drunkenness can rarely be pleaded as a defense in an action of tort (q.v.). In the United States there is judicial authority, however, for the admission of this plea when the tort complained of involves a special intent on the part of the defendant. Civil misconduct of that sort does not often come before the courts, and in the great majority of tort actions, such as those for assault and battery, for defamation, for negligence, and for trespass to land, the drunkenness of the wrongdoer has been held not a legitimate defense.

In criminal law it is well settled that drunkenness is not a justification or excuse for crime. Still, when an essential ingredient of the crime with which a prisoner is charged is the doing an act with a specific intent—as in entering a house by night with intent to commit larceny, or in assaulting a female with intent forcibly to ravish—the drunkenness of the actor may be taken into account by the jury in determining whether he acted with that specific intent. If the jury believe that he was so drunk as to be incapable of forming such specific intent, they are bound to acquit him of the offense charged.

In itself drunkenness is not a legal offense, though drunken conduct in public may be a nuisance and is often made a statutory offense, punishable by arrest, fine, and imprisonment.

When habitual, drunkenness may also render the drunkard liable to a judicial inquisition for the appointment of a committee or trustees to assume the guardianship of him and his property. The proceeding is properly instituted by the wife or children or next of kin of the alleged drunkard on the ground of his incompetence to control his acts or look after his property or business affairs. See *INSANITY*; *LUNACY*. Consult: Kent, *Commentaries on American Law*; Pollock, *Principles of Contract in Law and in Equity* (2d Amer. ed., G. H. Wald,

ed., Cincinnati, 1885); Bishop, *Commentaries on Non-Contract Law* (Boston, 1889); Woodruff, *Cases on Domestic Relations and the Law of Persons*, part v (New York, 1897). See *ALCOHOL*, *PHARMACOLOGY*, ETC.; *ALCOHOLISM*; *DIPSOMANIA*; *INTOXICATION*; *TEMPERANCE*.

**DRUNKEN PARLIAMENT**, THE. A name given to the Scottish Parliament of 1661, the members of which were accused of constant drunkenness. By one act it annulled the acts of the parliaments preceding it for 28 years and brought about the upheaval of the whole Scotch church system.

**DRUPE** (Fr., from Lat. *drupa*, Gk. *δρύππα*, *dryppa*, overripe olive, from *δρυπετής*, *drypepēs*, ripened on the tree, from *δρῦς*, *drys*, tree + *πέτρειν*, *peptein*, to cook, or *δρυπετής*, *drypetēs*, fallen from the tree, from *δρῦς*, *drys*, tree + *πίπτειν*, *piptein*, to fall). A stone fruit, in which the ovary wall, in forming the pericarp, develops an outer fleshy layer and an inner stony or bony layer, as in the peach, plum, cherry, etc. See *FRUIT*. For illustration, see Plate of *DRUPES*.

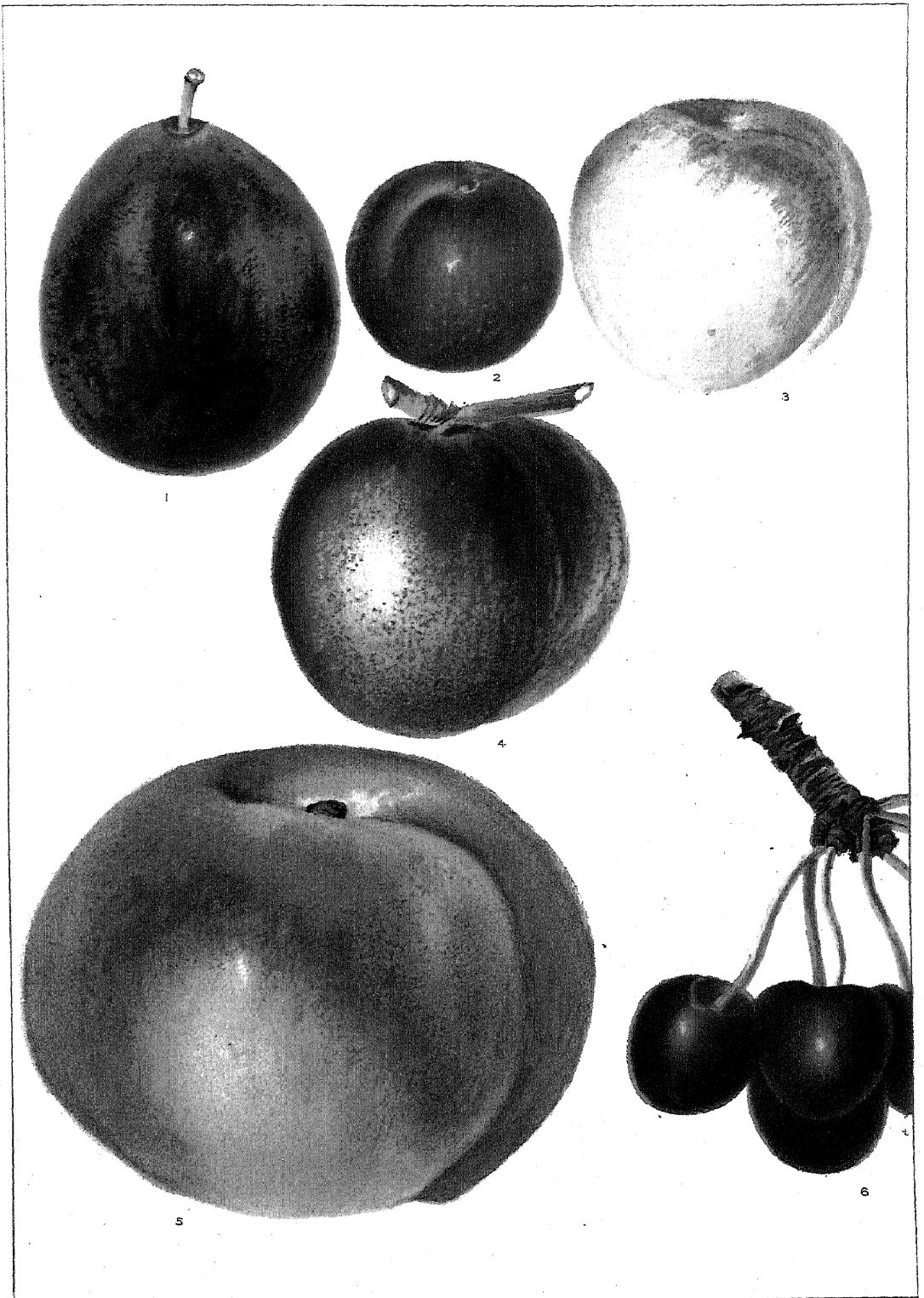
**DRUPELET**. A small drupe, as the individual "grains" of a blackberry, raspberry, etc. See *FRUIT*.

**DRURY**, DRU (1725-1803). An English silversmith and engraver, born in London. His *Illustrations of the History of the British Museum* (2 vols., 1773-82) is a work containing much valuable material and illustrated with a large number of beautiful figures. Besides this, he wrote *Illustrations of Natural History* (1770-82) and several other works and gathered a remarkably fine collection of insects.

**DRURY LANE**. A street in London, leading from the Strand towards Oxford Street and the British Museum; named after Sir William Drury, whose house during the reign of Henry VIII stood where the entrance from the Strand is now. It was a fashionable quarter under the Stuarts, but in Queen Anne's time its respectability had begun to decline.

**DRURY LANE THEATRE**. A famous London playhouse. It was first built, under royal patent, in 1663, by Thomas Killigrew (q.v.), whose company was known as the King's Company, in distinction from the Duke's Company of Davenant (q.v.). The house was originally called the Theatre Royal. Burned in 1672, it was rebuilt in 1674 from designs by Sir Christopher Wren. In the years that followed rivalry between the two companies was so ill-sustained that in 1682 they were united. A dozen years later, however, Betterton (q.v.) and others of the company made their well-known secession to Lincoln's Inn Fields, and in 1709 continued bad rivalry brought the theatre to a close. Colley Cibber and his associates renewed its prosperity, and Garrick's management, which followed (1746-76), was perhaps the most famous in its history, with "Peg" Woffington and "Kitty" Clive as leading stars. In 1791 the old building made way for a new structure which was opened three years later and managed by Sheridan. In 1809 this again was destroyed by fire, and in 1812 the present house was opened. The acting of Kean gave it prosperity for a time, but since his day Drury Lane and its managers have suffered numerous vicissitudes. In recent years it has been devoted largely to spectacular pieces and English opera. Consult Stirling, *Old Drury Lane* (London, 1881), and Doran, *In and About Drury Lane* (ib., 1881).

# DRUPES



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|-----------------|-----------------|--------------|-----------------------|--------------|
| 1 BRADSHAW PLUM | (EUROPEAN TYPE) | NATURAL SIZE | 4 BOSTON NECTARINE    | NATURAL SIZE |
| 2 MINER PLUM    | (NATIVE " ) " " | " "          | 5 CHAIRS CHOICE PEACH | " "          |
| 3 ROYAL APRICOT | " " " "         | " "          | 6 TARTARIAN CHERRY    | " "          |





**DRURY'S BLUFF, BATTLE OF.** See BER-MUDA HUNDRED.

**DRUSES**, drōō'ez. A people of mixed origin, who inhabit a district in Syria . . . southern portion of the Lebanon . . . ern slope of Anti-Lebanon as well as a large portion of the region of the Hauran. In the first-mentioned district they hold exclusive possession of about 40 towns and villages and divide the possession of about 200 more with the Maronites (q.v.), while 80 villages in other parts of Anti-Lebanon are peopled by them. They number about 100,000 or 150,000 and are probably derived from Kurdish, Persian, and Arab stock. Their religion is fundamentally Mohammedan, but of a peculiar type, which they adhere to with stern fanaticism. Early in the eleventh century Hakem, the Fatimite Caliph of Egypt, a cruel tyrant hated by his people, caused the incarnation of God in himself to be publicly preached in Cairo by his confessor, Darasi, who thereby brought upon himself the active hatred of the people. He escaped to the Lebanon, where he was received by the mountaineers and taught his new religion. From him the name "Druses" is probably derived. It was, however, by Hamze, a Persian disciple of Hakem, that the faith was given the form in which the Druses hold it. The Druses have maintained their religious and political independence for nearly nine centuries. Their faith mingles the teachings of the Mosaic law, the Christian Gospels, the Koran, and the Sufi allegories. Their seven cardinal principles are: (1) veracity in dealings with each other; (2) mutual protection and resistance; (3) renunciation of other religions; (4) belief in the divine incarnation in Hakem; (5) contentment with the works of God; (6) submission to His will; (7) separation from those in error and from demons. They believe in one God who has revealed Himself 10 times upon earth as mortal man, the incarnation in Hakem being the tenth and last. They believe in the transmigration of souls, with constant advancement and final purification. Their teachings enjoin abstinence from wine and tobacco, from profanity and obscenity. They are divided into the Akals, or initiated, and the Djahils, the ignorant. The latter are free from all religious duties. Between 1840 and 1860 there was bitter strife between the Druses and their immediate neighbors, the Maronite Christians. Owing to the shocking barbarities perpetrated by the Druses in 1860, the European Powers undertook to intervene in defense of the Christians. A French army was dispatched to Syria in August, and a commission of the Powers was appointed to investigate the facts. The Druses escaped into the Hauran desert, and it was found that Turks and Damascene fanatics were really responsible for stirring up the strife in which the Maronites had acted with a vindictiveness equal to that of the Druses. Punishment was meted out to the Mohammedans, who were principally responsible, and among others Achmet Pasha, the Governor of Damascus, was shot. In June, 1861, the troops returned to France, and the commissioners drew up a scheme of Government for the Lebanon. It provided for a Christian governor, appointed by the Porte, and the division of the region into seven districts, under chiefs of the religion prevailing in each. Fuad Pasha, an Armenian Christian, was the first Governor, and the district chiefs

included four Maronites, one Druse, one orthodox Greek, and one separatist Greek. The constitution did not satisfy the Maronites, whose revolt, under Joseph Karan, kept the Lebanon in a very unsettled state till 1867. During this period the Governor had to restrain the Druses from attacking the Maronite villages. They had no superior educational establishment until Fuad Pasha founded and endowed one at Abeih. Polygamy is unknown among them. They possess an extensive theological literature. They have with incredible toil carried the soil of the valleys up and along the hillsides, which are laid out in terraces, planted with mulberry, olive, and vine. Their chief trade is the manufacture of silk. Corn is raised, though in very small quantities. Deir-el-Kamar is the principal town. Consult: Silvestre de Sacy, *Exposé de la religion des Druses* (1838); Earl of Carnarvon, *Druses of the Lebanon* (London, 1860); Churchill, *Ten Years' Residence in Mount Lebanon* (ib., 1853); id., *The Druses and Maronites under Turkish Rule from 1840 to 1860* (ib., 1862); Guys, *La nation druse* (Paris, 1864); id., *La théogonie des Druses* (ib., 1863); Oliphant, *Land of Gilead* (London, 1880); id., *Haifa* (ib., 1887); Ewing, *Arab and Druze at Home* (ib., 1907).

**DRUSILLA, LIVIA.** See LIVIA DRUSILLA.

**DRUSILLA.** 1. The daughter of Germanicus and Agrippina, born in 15 A.D. She lived with her brother Caligula as his mistress until her death in 38. 2. The daughter of Herod Agrippa I, King of Judæa. She married Azizus, King of Emesa, but forsook him and married Antonius Felix, who became governor of Judæa, and before whom St. Paul appeared at Cæsarea.

**DRUSIUS**, drōō'si-ūs, JOHANNES (JAN VAN DER DRIESCHE) (1550-1616). A Flemish-Protestant scholar, born at Oudenarde. He studied at Ghent, Louvain, and Cambridge, and in 1572 was appointed professor of Oriental languages at Oxford. In 1577 he obtained a similar chair at Leyden and from 1585 until his death held the professorship of Hebrew at the University of Franeker, where he had students from England, and the Protestant countries of the Continent. He was employed by the States-General to annotate the Old Testament, and his edition is to be found in the *Critici Sacri* (London, 1660; Amsterdam, 1698). His complete works were published in 10 volumes (1622-36). Consult Nicéron, *Mémoires des hommes*, vol. xxii (Paris, 1733), and Diestel, *Geschichte des alten Testaments in der christlichen Kirche* (Jena, 1869).

**DRUSUS.** The name of a distinguished family of the gens Livia, which contributed a large proportion of eminent men to the Roman commonwealth. The most conspicuous of the Drusi were: 1. M. LIVIUS DRUSUS, tribune of the people in 122 B.C., who upheld the cause of the Senate and the nobles against his democratic colleague, Gaius Gracchus. 2. His son, who bore the same name as himself, and kept Rome in perpetual turmoil and disorder from 100 B.C. till his death in 91. Though identified by birth and sympathy with the patricians, Drusus, to win the people, revived some of the most liberal measures of the Gracchi and carried agrarian and frumentarian laws. During the latter years of his life he contrived to gather into his own hands the threads of the various political movements which resulted in the Social War; he even promised the Latins Roman citi-

zenship. This roused the Senate to abrogate his laws, and civil strife seemed certain, till one night Drusus was stabbed. 3. The most illustrious of the Drusi was Nero Claudius Drusus, commonly called Drusus Senior. He was son of Tiberius Claudius Nero and Livia Drusilla and so was the stepson of the Emperor Augustus and younger brother of the Emperor Tiberius. He was born in 38 B.C. As he grew up he developed splendid personal qualities as well as the highest capacity for civil and military affairs. He began his public career in 19 B.C. and signalized himself when only 23 years old by his defeat of the Rhetians and other Alpine tribes which were disturbing the north of Italy. In 13 B.C. he was sent into Gaul, then in revolt, and, after crushing the rebels there, pushed across the Rhine in pursuit of their German allies. In this campaign he subdued the Sigambri and the Frisii and forced his way to the German Ocean, being the first Roman general to do so. From this time he strove to establish the Roman supremacy in Germany, partly by conquest and partly by the execution of great military works. Among these latter may be mentioned the canal joining the Rhine with the German Ocean, two bridges over the Rhine itself, and the embankments of the Vahalis (Waal). In 11 B.C. he conquered the Usipetes, the Cherusci, and the Suevi; in the following year he subdued the Chatti and the Nervii; he was the work of subjugation in 9 B.C. when a fall from his horse cut short his brilliant career in his thirtieth year. For his exploits in Germany Drusus was rewarded with the title of Germanicus, a surname which passed over to his celebrated son. (See GERMANICUS.) Another of his sons was afterward the Emperor Claudius.

**DRUSUS, ARCH OF.** The name given to a travertine arch coated with marble over the Appian Way in Rome, said to have been erected in honor of Claudius Drusus, but in reality an arch of the aqueduct built by Caracalla to supply his baths. Of the arch really built in honor of Drusus, perhaps near the point where the Via Latina branches from the Via Appia, no trace has been found.

**DRUSUS CÆSAR,** usually called DRUSUS JUNIOR, to distinguish him from Nero Claudius Drusus (see DRUSUS, 3) (?-23 A.D.). The son of the Emperor Tiberius by his first wife, Vipsania Agrippina. He was made quaestor in 10 A.D. and consul in 15 A.D. but degraded the office by his excesses, and his father sent him with the army to Illyria. In 22 A.D. he received the *tribunicia potestas* and was looked upon as heir to the throne. Sejanus, wishing to supplant Drusus, deliberately won the affections of Livia, Drusus's wife, and together they caused the death of Drusus by poison.

**DRYADS** (Lat. *dryas*, from Gk. *δρύας*, *dryas*, wood-nymph, from *δρῦς*, *drys*, tree, oak), or HAMADRYADS. The nymphs of the trees and the forests. According to the popular belief each tree had its own dryad, who came into life with it, tenderly watched its growth, and died when it fell. The dryad was sometimes conceived as dwelling in her tree, sometimes as merely living near it. The name "dryad" is also employed in a general sense for nymphs who merely dwell in the forest without association with particular trees. See NYMPHS.

**DRYANDER**, dry-ân-dēr. ERNST (1843-). A German Protestant theologian, born

in Halle. He was educated at the universities of Halle and Tübingen from 1879 to 1882 was pastor of the Evangelical congregation in Bonn, and in the latter year became pastor of the church of the Holy Trinity in Berlin, where he quickly became known for his pulpit eloquence. In 1898 he became court preacher, in 1901 a life member of the Upper House of Prussia, and in 1907 vice president of the Evangelical Oberkirchenrat. His publications include *Predigten über das christliche Leben* (3d ed., 1890) and *Der erste Brief Johannis in Predigten ausgelegt* (1898).

**DRYANDER**, FRANZ. See ENZINAS.

**DRYASDUST**, REV. DR. The imaginary person who signs the introductory epistles to several of Scott's novels and the conclusion to *Redgauntlet*. The name is used as a synonym for a prosy writer and has become famous through Carlyle.

**DRYBURGH ABBEY.** An impressive ruin near Melrose, Scotland, which contains the tomb of Sir Walter Scott. It is an admirable example of the Norman and early English styles of architecture.

**DRYDEN.** A village in Tompkins Co., N. Y., 36 miles south-southeast of Auburn, on the Lehigh Valley Railroad (Map: New York, D 6). It has large woolen mills and granite and marble works. Sulphur springs and a healthful and attractive situation make the village a popular resort. The Southworth Library is a public institution. The water works and acetylene-gas plant are owned by the municipality. Dryden Township includes the village of Freeville, where is located the George Junior Republic (q.v.). Pop., 1900, 699; 1910, 709.

**DRYDEN, JOHN** (1631-1700). An English dramatist, poet, and critic, born at Aldwinkle, a village of Northamptonshire, Aug. 9, 1631. His father, Erasmus Dryden, was the third son of Sir Erasmus Dryden, or Driden, Baronet. Dryden received the rudiments of his education at Tichmarsh and was a King's scholar at Westminster School, under Dr. Busby. In 1649 he contributed an elegy to the *Tears of the Muses*, a collection of 33 poems on the death of Henry, Lord Hastings. The poem, written in the "metaphysical" style, was a poor performance even for a schoolboy. In May, 1650, he entered Trinity College, Cambridge, and in October was elected to a scholarship from his old school. Later in the same year he prefixed a few commendatory verses to the *Sion and Parnassus* of John Hoddesdon; he graduated B.A. in January, 1654. His father died in 1654 and left him a small estate estimated at £60 a year, of which sum his mother had life interest in a third. It is thought that he remained at Cambridge till 1657 and then took up his residence in London. Like the rest of his family, he was an adherent of Cromwell. In 1658 he published his first poem of importance, entitled *Heroic Stanzas to the Memory of Oliver Cromwell*. The restoration of Charles II he celebrated in two poems, *Astræa Redux* (1660) and *Panegyric on the Coronation* (1661). There is no good reason for doubting the sincerity of Dryden in these poems. He had admired Cromwell rather than Puritanism, and he was glad to see the old order restored. His social position, rather than his scientific attainments, was honored by election as fellow of the Royal Society (1662). He had become the friend of Sir Robert Howard, himself a poet, and on

Dec. 1, 1663, he married Sir Robert's sister, the Lady Elizabeth Howard, a woman whose previous reputation was not above the reach of scandal and with whom Dryden was unhappy. He had already begun his career as dramatist, and his first play, the *Wild Gallant*, was performed without success at the King's Theatre in February, 1663. During the next 20 years he produced many successful plays, although the comedies are coarse and the tragedies stiff. The best is *All for Love* (1678), founded on Shakespeare's *Anthony and Cleopatra*, written in blank verse, while his other tragedies are in heroic couplets. In the meantime he had produced *Annus Mirabilis* (1667), the subject of which is the Dutch war and the fire in London of the year before. In 1668 he published his great *Essay on Dramatic Poesy*, which established his reputation as one of the greatest English critics, but which led to a quarrel with his brother-in-law over the comparative merits of rhyme and blank verse. Though they both had written "heroic plays," i.e., melodramatic tragedies in rhymed couplet, Howard saw fit to defend blank verse against Dryden's preference for rhyme. Later Dryden himself went back to blank verse, when under the spell of Shakespeare. In 1670 he was appointed poet laureate and historiographer with a salary of £200 a year. This double post he held till the revolution in 1688. In 1671 the Duke of Buckingham produced a famous attack on the English heroic drama, of which Dryden was the head. This satirical piece was entitled *The Rehearsal*, and when it was brought on the stage the town was amused to find all the artificialities of this kind of writing brought together and exaggerated and charged to Dryden. Although personally satirized, Dryden endured his castigation in silence and, awaiting his opportunity, incidentally revenged himself on the witty and profligate Duke in *Absalom and Achitophel* (first part, 1681). This magnificent satire arose out of the political commotions of the times and is an elaborate defense of the King against the Whig party. Charles II is David; Monmouth, Absalom; Cromwell, Saul; Buckingham, Zimri; and Shaftesbury, Achitophel. Its success was amazing. Immediately after its publication Shaftesbury was arrested on a charge of high treason, but the London grand jury, on November 24, threw out the indictment. His release was celebrated by a medal, with his portrait on one side and on the other a representation of the city of London. In March, 1682, Dryden published his satire *The Medal*. One of the numerous replies to this satire was written by a former friend, Thomas Shadwell, who attacked Dryden in a savage poem, *The Medal of John Bayes*. Dryden took a crushing revenge in his immortal *MacFlecknoe*, published October, 1682. In November Nahum Tate brought out a continuation of *Absalom and Achitophel*, into which Dryden inserted a passage containing magnificently savage portraits of Elkanah Settle, another of his enemies, and of Shadwell. His critics now crushed, Dryden became the undisputed king and lawgiver of English literature in his day. In 1682 he stated and maintained the doctrines of the Church of England in a poem entitled *Religio Laici*.

After the death of Charles II Dryden became a convert to the Roman Catholic faith. This event was announced by the publication of *The*

*Hind and Panther* (1687). For this change of faith he has been much abused. Macaulay calls him "an illustrious renegade." Others strenuously defend his sincerity. At the revolution he was deprived of his laureateship, and, somewhat straitened in circumstances, he turned again to the stage. His translation of Vergil, begun in 1694, was published in 1697. In 1687 he had written his beautiful *Song for St. Cecilia's Day*, and exactly 10 years later he treated the subject with still greater success in his noble ode, *Alexander's Feast*. Both poems were written for a London musical society and were set to music. In 1699 he published, under the title of *Fables*, versions of Ovid, Boccaccio, and Chaucer, to which was added one of his great prefaces. He died May 1, 1700, and on the 13th was buried in Westminster Abbey.

Although the great bulk of Dryden's work consists of plays which are for the most part devoid of character, feeble in sentiment, false to nature, and exaggerated in expression, he must always remain a prominent figure in English literature. His *Satires* are masterpieces. In these he is masculine and natural, and his versification flows on, broad, deep, and majestic. Nor is it only as a poet that he excels; his prefaces and *Essay on Dramatic Poesy* prove him to be a master of "that other harmony of prose." Dryden's plays were published separately during his lifetime. His poems were collected in 1 vol. (1701), in 2 vols. (1742), and in 4 vols. (1760). His prose was collected in 4 vols. by Malone (1800). His *Complete Works* were edited with a *Life*, by Walter Scott in 18 vols. (Edinburgh, 1808; reprinted 1821, and revised by Saintsbury, 1882-93); the *Poetical Works* were edited, with a *Life*, by Christie (London, 1870); and a critical edition of *Essays*, ed. by Ker, was published in Oxford in 1900. Consult also: Garnett, *Age of Dryden* (London, 1895); and for his biography, Saintsbury (ib., 1881); Beljame, *Le public et les hommes de lettres en Angleterre (1660-1744)* (Paris, 1881); Collins, *Essays and Studies* (London, 1895); Ward, *History of English Dramatic Literature*, (ib., 1899); Chase, *The English Heroic Play* (New York, 1903); Frye, *Dryden and the Critical Canons of the Eighteenth Century* (Lincoln, Neb., 1907); Sargant, *Poems* (Oxford, 1911); Noyes, *Poetical Works* (Boston, 1909). For a complete bibliography, consult the *Cambridge History of English Literature*, vol. viii (New York, 1912).

**DRYDEN, JOHN FAIRCHILD** (1839-1911). An American insurance official, born near Farmington, Me. After attending Yale College he entered business as a life-insurance agent. In 1873 he founded the Widows' and Orphans' Friendly Society, the successor of which (1875), the Prudential Life Insurance Company, became one of the greatest corporations of its kind in the United States. Dryden was a presidential elector in 1896 and 1900, and, to fill an unexpired term, he was United States Senator from 1902 to 1907. As a candidate in the latter year for election for a full term, he met so much opposition that he withdrew in favor of John Kean. He was one of the organizers of the Public Service Corporation of New Jersey and was interested in other financial and industrial concerns. He published *Addresses and Papers on Life Insurance and Other Subjects* (1909) and also other lectures and speeches.

**DRY DOCK.** See Dock.

**DRY FARMING** is the generally profitable production of useful crops without irrigation under a rainfall of 20 inches or less. This is accomplished through suitable methods of soil tillage and farm management, but the controlling factor is the amount of precipitation. The chances of success decrease as the rainfall diminishes. The underlying principle is the storage and conservation of moisture in the soil in quantities sufficient to produce profitable crop growth and the selection or introduction of drought-resistant crops. Dry farming does not mean growing crops on dry soils, but under conditions of a limited or more unfavorably distributed rainfall. The problems which enter into the practice are the storage and retention of moisture in the soil at all times, the water requirements of plants as a basis of crop selection, soil management, and methods of crop utilization and marketing. With the proper attention to all these factors profitable crops are practically assured with a rainfall of over 15 inches, but with a precipitation of 10 to 15 inches crop culture becomes more difficult and the work more exacting, while with less than 10 inches a paying return is exceptional. In the United States these different degrees of precipitation exist quite generally in the region west of a line running through the Dakotas, Nebraska, Kansas, Oklahoma, and Texas, and extending to and including eastern Washington and Oregon and eastern and southern California. In general, regions having less than an equivalent of 10 inches of rainfall are regarded as arid and those with a precipitation of 10 to 20 inches as semiarid. Over one-half of the United States requires either irrigation or the use of dry-farming methods to make agriculture profitable and the same is true of regions of Europe, mainly in Russia, and of Asia, Africa, South America, and Australia; in fact more than one-half of the earth's surface is arid or semiarid. Deep and uniform soils are best adapted to dry farming. A hardpan too near the surface interferes with root penetration and thus limits the utilization of soil moisture by the crop, while gravelly layers facilitate leaching and destroy capillarity. The soil management in dry farming is based on the principle of storing the largest possible amount of the annual precipitation in the soil for the use of the crop. The purpose of it is to reduce the run off to a minimum and to increase the absorption and retentive powers of the soil to a maximum. By deep and proper cultivation the upper foot of soil is rendered absorptive, enabling water to sink into the lower layers and to be held there for future use by keeping the surface in suitable condition. A good subsoil has a great water-storing capacity. Deep plowing is practiced so that water may be taken up readily and in large quantities and be prevented from rapidly evaporating under the actions of sunshine and wind. It is essential that the land be plowed immediately after the crop has been harvested and that at all times a loose dry soil mulch be kept at the surface to check evaporation. This soil mulch is generally most effective when it is 8 to 10 inches deep, quite uniform in texture, and not too finely pulverized. Cultivation is given at frequent intervals and is especially important early in spring. Clean summer fallowing is practiced every other year with a low rainfall and every third or fourth year under a higher

rainfall. Weeds draw upon the soil moisture supply, and the land is therefore kept free from them at all times. The crops best adapted to dry farming and those generally grown are wheat, oats, barley, rye, which is one of the surest, emmer, corn, potatoes, sorghums, such as Kafir corn, milo maize, durra, feterita, etc., alfalfa, field pea, and field bean. Among fruits the date and the olive are essentially dry-farm crops. By selection and adaptation of varieties to dry-farm conditions much greater success has been secured and the dry-farming area extended. Sowing is done when conditions for germination are most favorable, which for many crops is in the fall, and in early spring when moisture is likely to be most abundant. It is aimed to place the seed just deep enough to insure germination, and for this purpose the use of the drill is always considered better than broadcasting. Thin seeding is generally practiced, the seed used being only about one-half the quantity used in humid regions. Wheat, oats, and barley are sown at the rate of about three pecks per acre, and corn at the usual distances is planted only two in a hill. After seeding and planting the land is worked with the disk harrow, corrugated roller, spike-tooth harrow, weeder, or cultivator to prevent the formation of a surface crust. Dry farming, as a rule, produces crops low in water content and in carbohydrates, and high in protein. The fertility of the soil, which is a regulator of transpiration, is maintained to a certain extent by growing leguminous crops in rotation wherever this is possible and by turning under all crop residues. The small grains are usually harvested with a header, and the straw is plowed down. To facilitate decay and improve the condition of the soil for the retention of moisture, the crops and crop residues to be turned under are cut up by means of the disk harrow before plowing is begun. Sometimes the land is plowed 7 to 10 inches deep and is then subsoiled to increase the moisture reservoir, but the practice is expensive and does not always prove profitable. Dairying, in connection with the silo to preserve green feed which cannot be matured on account of drought, is proving successful in many sections, in some cases pits being used in place of above-ground silos to save expense. In addition to the different kinds of plows the implements largely used in dry farming are spike-tooth, spring-tooth, and disk harrows, narrow-toothed and narrow-shoveled cultivators, the subsurface packer used in packing loose soils such as those containing crop substance turned under, and the disk drill and seeder, or the drill seeder with press wheels. The Campbell system of soil culture brought into prominence from 1890 to 1900 was essentially a system of dry farming. The first dry-farming congress was held in Denver in 1907. This itinerant congress, now an annual and international affair, is generally held in connection with an agricultural exposition mainly with reference to dry-farming products. Consult: Widdsoe, *Dry Farming: A System of Agriculture for Countries under a Low Rainfall* (New York, 1911); Shaw, *Dry Land Farming* (St. Paul, 1912); Olin, *American Irrigation Farming* (Chicago, 1913). Consult also the publications of the United States Department of Agriculture and of the Departments of Agriculture of the Western States.

**DRY-FLY FISHING.** See FLY CASTING.

**DRY GANGRENE**, gān-grēn'. See ERGOTISM.

**DRYING MACHINES.** Devices for the speedy drying of textile materials. The machine commonly used for removing the excess of liquor from textile materials consists of two drums, or cylinders, open at the top; the inner one, into which the goods are packed, is perforated at its sides and made to revolve with great velocity. The use of the outer cylinder is merely to catch the drops of water thrown out by centrifugal force as the wet material or clothes rapidly revolve. These drying machines are commonly called extractors or centrifugal wringers. A simpler drying machine, called a wringer, consists of two rollers mounted parallel, and one above the other, with an adjustment to vary the distances between them. One end of the article to be dried is inserted between the rollers, which are then brought as close as possible together, and one roller is turned by a handle; the other, being free to revolve, turns also as the clothes pass between them—the moisture in this case being extracted by pressure as in the common process of wringing. The drying is not, however, quite completed by such machines, and the remaining moisture is removed by open-air or hot-chamber drying or by passing over heated cylinders or coils of steam pipes. In the various branches of textile and paper manufacture drying apparatus adapted to the particular industry is used, and is described in the separate articles on these subjects.

**DRYING OILS.** See OILS.

**DRY MURRAIN**, mūr'rēn. See TEXAS FEVER.

**DRYNESS.** A technical term in painting, used to indicate a style in which the drawing is hard, angular, and formal, and the color deficient in harmony and mellowness. It is opposed to a free method of drawing and to the unctuous manipulation of pigment. In sculpture it indicates a lack of softness and roundness of form. Dryness is common to the primitive schools, which lacked command of the technique of painting; but it is found also in more developed art, being sometimes the result of personal temperament. Among modern painters certain of the Pre-Raphaelites have been criticized for this defect.

**DRYOPE**, dri'ō-pē (Lat., from Gk. Δρυόπη). The daughter of Dryops, a king of Thessaly who was the reputed ancestor of a people called Dryopes. She was the mother of a son by Apollo, who visited her in the form of a tortoise. She was finally carried off by the wood nymphs and changed into a poplar.

**DRYOPHIS.** See LANGAHA; WHIP SNAKE.

**DRY PILE.** A voltaic pile or battery consisting of a number of disks of paper covered with zinc foil on one side and gilt or black oxide of manganese on the other. Various modifications of the above form are also known by the same name. Following the invention of Volta (see VOLTAIC CELL OR BATTERY), Behrens in 1805 constructed a pile in which paper was used instead of moistened cloth, in consequence of which it was called a dry pile. The term "dry pile" is really a misnomer, as the pile is inactive unless the paper contains a certain amount of moisture. Behrens's construction was modified and improved by Zamboni, by whose name the dry pile is often known. In this apparatus the pile was made of so-called silver

paper and paper which had been rubbed with hydrogen peroxide. The couples were made of small disks of the paper so treated, placed together with their coated sides outward, and these were piled up to the number of 1000 or more, each couple or pair facing in the same direction. The entire pile was then firmly pressed into a glass tube varnished with shellac, and finally covered on the ends with brass caps. These have been made with as many as 20,000 pair of disks and capable of charging a thin Leyden jar of 350 square centimeters surface in 10 minutes to such an extent that its discharge melted 2.5 centimeters of platinum wire of .05 millimeter diameter.

The dry pile was employed by Behrens and Bohnenberger in the construction of a very delicate gold-leaf electroscope, commonly known by the latter's name. For this purpose the dry pile was constructed in two columns connected together below, so that the poles were at the upper ends. Between these poles a single gold leaf was suspended. As one pole is positive and the other negative, a very slight charge given to the gold leaf is sufficient to make it move towards one of the poles of the dry pile. The dry pile has also been applied to the construction of a "perpetual motion" electric pendulum, in which case it is divided into two columns, in the same way as in the electroscope just described, and between them a very light pendulum rod is balanced on knife-edges. On the upper end of the rod is a light metal ring which oscillates between the two poles. The pendulum inclines first to one side, and the ring touches one pole, at which it is charged. The pendulum is then repelled and carries it to the opposite pole, where the charge is neutralized, and it receives a charge of the opposite polarity, which reverses its motion. This action is repeated indefinitely. Such a pendulum has been in continuous motion in the University of Innsbruck since 1823. The period of its oscillation varies slightly with the humidity of the atmosphere. The energy expended is exceedingly minute, as no pile can generate a sensible current except by a corresponding consumption of its materials in the shape of chemical action. See VOLTAIC CELL OR BATTERY.

**DRY POINT.** The art and process of engraving on metal with a needle or other sharp point which scratches the surface. It differs essentially from line engraving in that none of the metal is cut away, and from etching in the absence of acid which corrodes the metal. In its effect dry point resembles etching rather than engraving because it is executed with the needle, not with the burin (q.v.), and in that the line is freely drawn. The scratches of the point cause a certain turning up or accumulation of the metal, in rough projection, beside the scratch or cut; this roughness is called the bur, and as it holds much more ink in printing than would a simple scratch of the needle, it gives a rich and soft effect of line, which is the peculiar charm of this medium. Dry-point work is often used to finish a plate which has been previously etched, because it can be applied without recoating the plate with the varnish and then using the mordant. (See ETCHING.) The term "dry point" is also applied to the needle with which the plate is scratched. It is nothing more than a rather heavy etching needle ground more obliquely and is sometimes pointed with a diamond, whence also the name "diamond dry-point

etching" as applied to the process. Consult the bibliography of ETCHING.

**DRY ROT.** A popular name for the decay of timber after it has been seasoned. Dry rot is usually slow in its action, though under some circumstances it may be rapid and destructive, ruining edifices and causing serious accidents. Dry rot is commonly caused by the fungus *Merulius lachrymans*. Somewhat similar effects are due to certain species of *Polyporus* and other fungi. The disease is quite common in timber that is exposed to moisture, as the ends of joists set in damp walls, wainscoting about sinks, etc. The timber is ultimately reduced to powder within a thin surface shell of sound wood. Although called dry rot, moisture is essential for the development of the fungus that causes it. The spores germinate and send their mycelium through the wood in all directions, attacking and destroying the wood fibres. At first the fungus appears as a thin white film which gradually thickens at the centre and changes to a rusty-brown color. A kind of timber known as red striped shows the beginning of dry rot. Perfectly sound timber may become infested by spores gaining entrance through cracks in the ends of logs, which, when wet, swell up. If the moisture be constant, the dry rot continues to grow, weakening the timber. The timber may dry out without destroying the fungus, which recommences developing when moisture is again present. The use of some kinds of sound-deadening material, such as wet cement, coal ashes, etc., is very favorable to the development of dry rot. Only dry gravel or coarse sand should be used. Coal cinders, etc., are alkaline, and the spores of *Merulius lachrymans* can be germinated best in the presence of alkalies. Timber that is well seasoned and protected by paint will not be attacked by dry rot.

A number of fungi attack the wood of trees, causing what is often called dry rot. Most of these fungi belong to the class of toadstools and shelf fungi and sometimes are seriously destructive. This form of rot is caused on apple trees by *Polyporus hispidus*; on oak, alder, poplar, locust, and larch, by *Polyporus sulphureus*; on larch, Scotch and white pine, by *Polyporus schweinitzii*; on conifers, by *Fomes pinicola*; etc. *Dactylea quercina* is a common saprophyte upon oak stumps and oak trees. The mycelium of this species forms leathery mats and is believed to be parasitic. The decomposing oak wood assumes a grayish-brown color.

**DRY STOVE.** See GREENHOUSE.

**DRY TORTU/GAS.** A group of ten islets belonging to Monroe Co., Fla., and situated at the extreme west end of the Florida Keys in lat. 24° 37' N. (Map: United States, K 6). They are of coral formation, low, and are partially covered with mangrove bushes. Fort Jefferson, on one of them, was a penal station during the Civil War. With the permission of the United States Lighthouse Board the Carnegie Institution of Washington established in 1904 on Loggerhead Key, one of the islands, a marine biological laboratory, at which much important scientific work has been done, and in 1908 the United States government set aside the entire group as a Federal bird reservation.

**DUAL** (Lat. *dualis*). A technical term of grammar, used to denote that form of the noun, pronoun, adjective, or verb which refers exclusively to two persons or things. The dual number differs, therefore, from the singular number,

which relates to one alone, and from the plural number, which relates indefinitely to three or more. The dual is regularly found in Sanskrit and in the most ancient Greek; and in Latin it appears in the pronoun *ambo* (both) and in the numerals *duo* (two) and *octo* (eight, i.e., two sets of four). It is not generally found in the Teutonic languages; yet the Gothic has it in the verb, and the Anglo-Saxon shows traces of it in two pronominal forms. It occurs in the Semitic languages, e.g., the Arabic and the Hebrew, though only in the nouns.

**DUAL CONTROL.** See EGYPT.

**DU'ALINE** (from *dual*, Lat. *dualis*, relating to two). The name given by C. Dittmar to that form of dynamite consisting of cellulose, nitrocellulose, nitrostarch, nitromannite, and nitroglycerin mixed in different combinations to the strength desired (United States Patent No. 4 of Jan. 18, 1870). A preferred composition put on the market was nitroglycerin, 50 per cent; fine sawdust, 30 per cent; saltpetre, 20 per cent. See EXPLOSIVES.

**DU'ALISM** (Lat. *dualis*, relating to two). In philosophy, the theory that the universe is explicable only as a whole with two fundamentally different kinds of constituent elements. The ancient dualism of matter and form has in modern times been replaced by a dualism of mind and matter as two different kinds of substance. Among modern philosophers Descartes was the first to emphasize the radical difference between thinking substance (mind) and extended substance (matter). The difficulty suggested by this view was to explain how mind and matter interact as they apparently do in experience. This perplexity caused some of his followers to deny interaction and assert concomitance of variation under divine control (see OCCASIONALISM); it caused others to deny the truth of dualism (see MONISM; SPINOZA; LEIBNITZ). In our day the question has been under more or less constant debate, and no unanimity has been reached as to the relative truth of dualism and its rivals. Within recent years the interest awakened by scientific psychology has brought the problem more to the fore, but even in psychology there is no consensus on the subject. (See PARALLELISM.) While idealism was the regnant philosophy, dualism was of course officially discarded. The recent reaction against idealism has in certain quarters, however, brought about a revival of dualism. One of the most interesting defenses of dualism is made by Prof. William McDougall (q.v.), who maintains that there is good evidence, both psychological and biological, for the existence of souls directing physiological processes. His position is frankly animistic, and the essential notion underlying animism is "that all, or some, of those manifestations of life and mind which distinguish the living man from the corpse and from inorganic bodies are due to the operation within him of something which is of a nature different from that of the body, an animating principle generally, but not necessarily or always, conceived as an immaterial and individual being or soul." Driesch (q.v.) comes to a similar conclusion, calling his nonmechanical principle "entelechy." Bergson (q.v.) in his second great work, *Matter and Memory*, takes likewise a dualistic position, matter being what we perceive with our senses and having in itself the qualities that we perceive in it, such as color and resistance. Mind, on the other hand, re-



veals itself as memory, the faculty of storing up the past and utilizing it for modifying our present actions, which would otherwise be merely mechanical. However, in his more recent work, *Creative Evolution*, Bergson takes a more monistic view, regarding matter as vital impulse which has become arrested. Vital impulse, *l'élan vital*, is, "for want of a better name," called by him "consciousness in general," "which must be coextensive with universal life."

But not all recent reactions against idealism have resulted in dualism; or at least, if what results be called dualism, it is a dualism in many cases of function and not of ontological character. Thus, W. James (q.v.) and John Dewey (q.v.) maintain that there is no unalterable difference between the physical and the psychic. The same thing may be the one or the other according to the way in which it behaves in experience. James says that there is no difference in quality or substance between "mental knives," i.e., what would ordinarily be called imaginary knives, and physical knives. The difference is that while mental knives may or may not cut mental wood, physical knives will regularly cut physical wood. For Dewey anything is physical which is accepted without question and treated in our action as unquestionable; it is psychic when it becomes problematic and forms the point of departure for a process of testing. One of the merits claimed for such a functionalistic distinction is that it frees us from the necessity of raising the time-worn problem as to the way in which mind acts on body and body on mind.

It is impossible here to give more than the preceding illustrations of the vast variety of views current at present on the problem of dualism. With perhaps a few exceptions, e.g., McDougall, the belief in mind and matter as distinct substances is generally discarded. The older dualism of substance is giving way to newer distinctions, such as the functionalistic distinction made by James or Dewey, or to distinctions of character, or to monisms, whether idealistic, materialistic, or neutral. See IDEALISM; INSTRUMENTALISM; MONISM; MATERIALISM; PRAGMATISM; REALISM. Consult: McDougall, *Body and Mind* (New York, 1911); James, *Essays in Radical Empiricism* (ib., 1912); Dewey, *Studies in Logical Theory* (Chicago, 1903); Driesch, *Science and Philosophy of the Organism* (London, 1908-09); Bergson, *Matter and Memory* (Eng. trans., ib., 1911); *Creative Evolution* (Eng. trans., New York, 1911); Royce, *The World and the Individual* (ib., 1900-01); Ward, *Naturalism and Agnosticism* (ib., 1899); id., *The Realm of Ends* (ib., 1911).

**DUALITY** (Lat. *dualitas*, state of being twofold, from *dualis*, relating to two). A principle of geometry by which one proposition is transformed into another through the interchange of a pair of elements; e.g., the proposition: If two triangles have two *sides* and the included *angle* of the one respectively equal to two *sides* and the included *angle* of the other, the triangles are congruent, may be transformed by the interchange of the words *sides* and *angles* into another familiar proposition: If two triangles have two *angles* and the included *side* of the one respectively equal to two *angles* and the included *side* of the other, the triangles are congruent. This principle is often called the principle of reciprocity and is extensively used in geometry. Although the reciprocal of a

valid proposition is not of itself necessarily valid, it often suggests new possible theorems for investigation. In plane geometry the dual elements most commonly ' ' ' ' ' are:

point—line;

line—point;

angles of a triangle—

(opposite) sides of the triangle;

sides of a triangle—

(opposite) angles of the triangle;

pencil of lines—range of points;

range of points—pencil of lines.

Similarly there are dual propositions of solid geometry, as those formed by interchanging the words *straight line* and *plane*; e.g., two intersecting *straight lines* determine a *plane*; two intersecting *planes* determine a *straight line*. Such dual propositions also exist, one in plane geometry and the other in solid geometry, as when the terms *triangle* and *trihedral angle* are interchanged; e.g., one *side* of a *triangle* is less than the sum of the other two sides; one *face angle* of a *trihedral angle* is less than the sum of the other two face angles. The term *duality* appears in the projective geometry of Gergonne (1813), and the development of the "principle of duality" in another work by the same author (1826). This principle is a powerful agent of modern geometry, where the term is more strictly defined than above and where the theory is carefully developed, and it has been applied to various properties of curves.

**DUANE, dū-ān'**, JAMES (1733-97). An American lawyer and jurist. He married into the Livingston family, studied law, and attained great prominence in his profession before the Revolution. In the heated political discussions preceding the war he opposed all radical measures, being ready to sacrifice much for the sake of peace. He was chosen a delegate to the first Continental Congress in 1774 and aroused violent opposition by his proposal for a recognition of the validity of the British Navigation Acts and his advocacy of Galloway's scheme for a union of all the Colonies under a chief magistrate appointed by the King. His distrust of a republican form of government led him vigorously to oppose the Declaration of Independence. He refused to hope for pacification until the last, but when the break came he threw in his lot with the Patriot party. He continued a member of the Continental Congress throughout the entire Revolutionary period, taking an active part in the debates. He was one of the authors of the first New York State constitution, was a member of the Committee of Safety in New York City in 1776-77, and after the evacuation of the city by the British in 1783 he was chosen the first mayor under the new charter, serving until 1789. In that year he was appointed by Washington to the office of United States District Judge for New York, which he held until 1794, rendering many decisions which were of considerable importance in the formative period of the country's existence. He was a member of the State Senate in 1782-85 and in 1789-90, and of the convention that adopted the Federal Constitution in 1788.

**DUANE, JAMES CHATHEAM** (1824-97). An American military engineer, born in Schenectady, N. Y. He graduated at Union College in 1844 and at West Point in 1848; commanded the engineer company in the Utah expedition of 1858, and was instructor at West Point from



that year until 1861. In the Civil War he served with distinction as captain of engineers in the Peninsular campaign of 1862; was chief engineer of the Army of the Potomac in the battles of South Mountain and Antietam; was chief engineer of the Department of the South for a time in 1863; and from July, 1863, until the close of the war again served in the Army of the Potomac. He was brevetted brigadier general in 1865, was promoted lieutenant colonel in the regular army in 1867, had charge of the construction of the fort at Willets Point, N. Y., from 1865 to 1868, served as superintendent of fortifications on the Maine and New Hampshire coasts, and in 1886 became chief of engineers with the regular rank of brigadier general. He published a *Manual for Engineer Troops* (1862).

**DUANE, WILLIAM** (1760-1835). An American politician and journalist, born in northern New York near the banks of Lake Champlain. He was sent to Ireland in 1771 to be educated, learned the printer's trade, and in 1784 went to British India, where he made a fortune and established a newspaper called the *World* at Calcutta. In consequence of too free criticism of the government authorities there, Duane was kidnapped at the command of Sir John Shore, the Governor, and deported to England, while his property in India was confiscated. Duane's efforts to obtain relief, either from the East India Company or the British government, were unavailing, and he again entered the field of journalism, becoming editor of the *General Advertiser*, in London, a paper which later was merged in the *London Times*. In 1795 he returned to America, where he became associated with Benjamin Franklin Bache in Philadelphia in editing the *Aurora*, one of the strongest Republican organs in the country. Forming an alliance with Michael Leib and other radical Republicans, he dominated the party in Pennsylvania for several years. In the *Aurora*, following the journalistic methods introduced in America by Cobbett, he attacked his political and personal enemies bitterly and unsparingly, filling his columns with fierce invective, insinuations, and scandal of every sort. Not only were the Federalists the objects of his attacks, but, disappointed in not receiving from Jefferson rewards commensurate with what he conceived to be the value of his services to him, he set out to hamper the administration and to sow discord among its members. He attacked Gallatin constantly, attempting to arouse Jefferson's jealousy by declaring that he was seeking to become his successor in the presidency. In 1800 he was indicted by him in connection with the Alien and Sedition Act. The Count Bill led to his being summoned before the bar of the United States Senate on a charge of libel. He was arraigned, but refused to appear for trial or put in a defense, denying the Senate's jurisdiction. He was adjudged guilty of contempt, and his arrest ordered, but he was never arrested. In Pennsylvania politics he exerted great influence and originated the organization known as the "Friends of the People" in opposition to that wing of the party represented by Gallatin, Dallas, and McKean. In 1804 he pressed the wholesale impeachment of the State Supreme Court judges. The transfer of the seat of government to Washington decreased the importance of the *Aurora*, which grew more abusive as its influence grew less. In 1808, just before retiring,

Jefferson appointed Duane a lieutenant colonel in the army. He continued to edit the *Aurora* and attacked Madison in particular, who quieted him in 1813 by an appointment as adjutant general. He sold the *Aurora* in 1822 and after traveling in South America wrote *A Visit to Colombia in 1822-23* (1826). He also published: *The Mississippi Question* (1803); *Military Dictionary* (1810); *An Epitome of the Arts and Sciences* (1811); *Handbook for Riflemen* (1813); *Handbook for Infantry* (1813); *American Military Library* (1819).

**DUANE, WILLIAM JOHN** (1780-1865). An American lawyer and financier. He was born in Clonmel, Ireland, studied law, was admitted to the bar in 1815, and practiced his profession in Philadelphia. He obtained distinction as a lawyer and, becoming interested in education, served as a trustee and subsequently as a director of Girard College. In 1833 he was appointed Secretary of the Treasury by President Jackson, but was removed later in the year for refusing to withdraw the government deposits from the United States Bank without authority from Congress. He was the author of: *The Law of Nations Investigated* (1809); *Letters on Internal Improvements* (1811); *Narrative and Correspondence Concerning the Removal of the Deposits* (1838).

**DUBAN, du'bän', FELIX LOUIS JACQUES** (1797-1870). A French architect, born in Paris. A pupil of Debret at the Ecole des Beaux-Arts, he won the Grand Prix de Rome in 1823 and spent five years in Italy. Returning to Paris in 1828, he joined with Duc and Labrousse in the *Néo-grec* movement to reform architecture. His chief work was the reconstruction and extension of the Ecole des Beaux-Arts buildings, on which he labored from 1832 until his death. The library, Pompeian court, and museum of architectural casts are especially admired. Meanwhile he was restoring the Château of Blois, and supervising extensive operations at Fontainebleau, Compiègne, and the Louvre. On the last, however, he was in 1853 superseded by Visconti (q.v.).

**DU BARRY, du bá'ré', MARIE JEANNE BÉCU, COMTESSE** (1743-93). The celebrated mistress of Louis XV. She was born Aug. 19, 1743, at Vaucouleurs, and was the natural daughter of a woman named Anne Bécu, who about the year 1749 returned to Paris with her two children, Jeanne and Claude, and married a domestic named Rançon. The beauty of little Jeanne won her many friends, chief of whom was the rich financier and philanthropist M. Billaud-Dumonceaux. Through him and the Abbé Arnaud she was admitted to the convent school of Sainte-Aurèle. There she remained for some seven or eight years, acquiring but little knowledge and enduring a great deal of irksome discipline. Emerging from the convent at the age of 15, Jeanne Bécu—or Jeanne Rançon, as she appears then to have been called—dwelt with her mother for a time and then became a lady's maid to Madame de la Garde and later a milliner in the house of a certain Sieur Labille, where she doubtless had many love affairs. She was at this time known as Mademoiselle Lange, but soon assumed the more aristocratic cognomen of Beauvarnier. In the midst of her gallantries Jeanne Bécu met the dissolute Comte Jean du Barry, known specifically as "the Roué," who made her his mistress and induced her to change her name to Vaubarnier or Vaubernier,

by which she is generally known with the subsequently added prefix Gomard. For four years she presided over the gaming rooms of her lover, until in the spring of 1768 she came in the path of Louis XV, who was immediately captivated by her charms and made her his mistress. To add a show of decency to the matter, a husband was found for her in the person of Comte Guillaume du Barry, the brother of Comte Jean. For five years the Du Barry ruled King and court. The Duc de Choiseul was her confidant and adviser, the Comte de Maupéou used her influence to dismiss and exile the Parlement in 1771, while the Abbé Ternay was suave and polite to her at all times. She was the patron of artists and men of letters, and during her reign she is estimated to have cost France 35,000,000 livres. She had numerous enemies, however, chief of whom was the Duc de Choiseul, Minister of Foreign Affairs, whose dismissal she brought about in 1770. The death of Louis XV caused her retirement from the court. Some time after the outbreak of the Revolution she went to London to see about the recovery of her jewels, which had been stolen. On her return Robespierre caused her to be arrested, July, 1793. In November she was tried before the Revolutionary Tribunal and accused of "having wasted the treasures of the state, of conspiracy against the Republic, and with having, in London, worn mourning for the late King." She was condemned to death and was sent to the guillotine, Dec. 7, 1793. Most of the accounts given of Madame du Barry are unreliable. She was the victim of much slander, and stories concerning her amours are rarely trustworthy. The *Mémoires* (6 vols., Paris, 1829-30; Eng. trans., 1830; 1896), published under her name, have no real value. Consult: Douglas, *Life and Times of Madame du Barry* (London, 1896); Lacretelle, *Histoire de France pendant le dix-huitième siècle* (Paris, 1830); Vatel, *Histoire de Madame du Barry, etc.* (Versailles, 1880); Goncourt, *La Du Barry* (Paris, 1880); Williams, *Madame du Barry* (New York, 1909).

**DU BARTAS.** See BARTAS.

**DUBBS, JOSEPH HENRY** (1838-1910). An American Reformed church clergyman, born at North Whitehall, Pa. He graduated at Franklin and Marshall College, Lancaster, Pa., in 1856, and at Mercersburg Theological Seminary in 1859. He was professor of history and archaeology in Franklin and Marshall College from 1873 to his death, and acted as president of the college in 1904 and 1907. He was an authority on the history of the Reformed (German) church in the United States. His principal publications include: *Historic Manual of the Reformed Church* (1885); *Home Ballads and Metrical Versions* (1888); *History of the Reformed Church* (1895); *Leaders of the Reformation* (1900); *History of Franklin and Marshall College* (1903); and contributions to the *Schaff-Herzog Encyclopædia*, *Hastings Encyclopædia of Religion and Ethics*.

**DU BELLAY, JOACHIM.** See BELLAY.

**DUBIS.** See DOUBS.

**DUBLIN.** A maritime county in the east of Leinster Province, Ireland, bounded on the north by Meath, on the east by the Irish Sea, on the south by Wicklow, and on the west by Kildare and Meath (Map: Ireland, E 3). Area, 342 square miles; including Dublin County borough, 354 square miles. The coast, indented by creeks and bays, is 70 miles long. Dublin

is the best-cultivated county in Ireland. The chief crops are oats and potatoes. There are important fisheries of turbot, salmon, brill, sole, plaice, cod, haddock, and oysters. The manufactures (chiefly cotton hosiery, distilled and malt liquors, and ships) are mostly confined to Dublin and the vicinity of the metropolis and are of more value than in any other Irish county. Dublin, Down, Antrim (with their county boroughs), and Kildare were the only Irish counties showing an increase of population, according to the 1911 census. Dublin County increased from 148,210 in 1891 to 157,568 in 1901 and 172,394 in 1911 (exclusive of Dublin County borough). Including the county borough, the population was 416,860 in 1891, 448,206 in 1901, and 477,196 in 1911. Roman Catholics numbered about 384,912, Protestant Episcopalians 80,466, Presbyterians 9264, Methodists 5541, and Jews 3000. The large towns of the county are the urban districts constituting the suburbs of Dublin City, viz., Rathmines and Rathgar, with 38,190 inhabitants in 1911; Pembroke, 29,260; Kingstown, an important port, 17,227; and Blackrock, 9081. Dublin County returns two members to the Parliament at London, and Dublin County borough four members.

**DUBLIN** (Ir. *Dubh-linn*, Black Pool). The capital of Ireland, a city and county borough, situated in the Province of Leinster and geographically in Dublin County, at the mouth of the river Liffey and on Dublin Bay, an inlet of the Irish Sea, in lat. 53° 23' N. and long. 6° 20' W. (Map: Ireland, E 3). The city is generally flat. The river, running from west to east, divides the city into two almost equal portions; in its lower course it is bordered with quays, largely of granite, and, between the quays and Phoenix Park on the west, is crossed by 12 bridges. On each side there is a spacious roadway, with tall houses and excellent shops. Near the customhouse are several large docks in communication with the Royal and Grand canals; the former connecting Dublin with the North Shannon and the west of Ireland, the latter with the southern portion of the same river and the south. The harbor and docks are protected by two large breakwaters. By improvements made at the beginning of the present century vessels drawing 23 feet can lie alongside the quays at low water. In the newer parts of Dublin the streets run at right angles and are remarkable for their breadth. The most imposing is Sackville Street, which is 120 feet broad. At its north end is the Rotunda, with Rutland Square—in its centre are the beautiful Ionic portico of the general post office and Nelson's Monument (134 feet high). A feature of Dublin are the squares, which are numerous, spacious, and sometimes well kept. The southeast and northeast quarters contain many beautiful squares, with splendid streets and terraces. The centre and the northwest quarter are the great emporiums of trade and the residence of the middle classes, many of whom have private houses in the suburbs. The southwest division part of which is called the Liberties, once the seat of the silk trade, is the slum district. The streets in this quarter are narrow, crooked, and irregular. The city is surrounded by the Circular Road, nearly 9 miles in length, forming a favorite drive and promenade.

There are numerous places of worship, Catholic and Protestant, monasteries, convents, priories, and a Jewish synagogue. The most re-

markable are the Protestant churches are St. Patrick's, founded in 1190, and restored in 1864 through the munificence of Sir Benjamin Lee Guinness, and Christ Church Cathedral, founded in 1038 and restored in 1870-77 at the charge of Henry Roe; and among the Roman Catholic, St. Mary's, St. Saviour's, St. Augustine's, St. Kilvin's. The public buildings include the Bank of Ireland, formerly the House of Parliament, Trinity College, the handsome customhouse (1781-91), and the Four Courts. Dublin Castle has no pretensions to architectural beauty; it dates from the early thirteenth century, but most of it was built after the fifteenth. There are monuments of William III in College Green, now a paved street; of Nelson, the Duke of Wellington, Goldsmith, Burke, Grattan, and many others on various public sites. The environs of Dublin are especially beautiful. Rathmines, a southern suburb, is a favorite residence of the wealthier part of the mercantile community. Glasnevin, on the north, deserves special notice as the favorite residence of the poet Tickell, of Addison, Steele, Parnell, Swift, Sheridan, and many other celebrities. In the cemetery at Glasnevin lie the remains of Curran, O'Connell, and Tom Steele. Phoenix Park, at the west of the city, is a magnificent area, of over 1750 acres, and further enlarged in 1905, in some parts level, in others with broken ground, having a large amount of timber and brushwood, which shelter herds of deer. It affords ample scope for military reviews and is extensively used by the inhabitants of Dublin for recreation. The Lord Lieutenant or Viceroy of Ireland holds his court in Dublin Castle during the winter months and in the summer season removes to the Lodge, situated in Phoenix Park.

The chief educational institution of Dublin is Trinity College. (See DUBLIN, UNIVERSITY OF.) There is also the Catholic University (1854), a Jesuit institution. The Royal University of Ireland, an examining body, was dissolved under an Act of 1908 and was superseded by the National University of Ireland; the constituent colleges are University College in Dublin, University College in Cork (formerly Queen's), and University College in Galway (formerly Queen's). There are many literary and scientific societies. There are two botanic gardens. The hospitals, asylums, orphanages, and other charitable institutions are numerous and liberally maintained. The municipal affairs are under the control of a town council, comprising the lord mayor, 20 aldermen, and 60 councilors. The city owns docks and wharves, the water supply, markets, municipal tenements, and an electric-lighting plant, and maintains parks, zoological gardens, a museum and library, an art gallery, and a model school. The city sends four members to Parliament. The chief manufactures are porter, whisky, and poplin. Dublin has a large import, but a small export trade. Imports in 1911 and 1912 were valued at £2,957,741 and £3,258,654 respectively; exports, £149,491 and £155,134; net tonnage entered, 221,793 and 258,541, and cleared, 90,258 and 64,448. Its chief imports are grain, raw cotton, metal ores, timber, petroleum, sugar, cork, and butter; exports wool, manure, iron and steel manufactures, whisky. Much of the inland traffic is carried on by the canals above mentioned and by the railways extending to all parts of Ireland. Dublin County borough has an area of 7911 acres and is

the largest city in Ireland. The population in 1891 was 268,587; in 1901, 290,638; in 1911, 304,802. With its suburbs (the urban districts of Rathmines and Rathgar, Pembroke, Blackrock, and Kingstown), the population in 1911 was 403,000, while that of the metropolitan police district was about 416,000. The great majority of the inhabitants are Roman Catholics.

**History.** Frequently called *Bally Achlee*—(town of the hurdle ford) from the ford of hurdles that spanned the river in this vicinity, this name was probably antedated by the perpetuated *Dubh-linn* (the black pool) and the *Eblana* of Ptolemy. Christianity was introduced by St. Patrick, who in 448 baptized the King of Baile-atha-eliath. From the ninth century until 1170, with interruptions, Dublin was held by the Danes. The Anglo-Norman Conquest by Strongbow and Henry II finally dispossessed them. During this period it became an ecclesiastical centre, being made the seat of a bishopric in 1038 and an archiepiscopal city in 1152. James II held a parliament here in 1689 and founded a mint, and in St. Patrick's Cathedral William III returned thanks for the victory of the Boyne. Lord Fitzgerald (q.v.) planned to seize the city and castle during the rebellion of 1798, but was captured before the attempt was made, and Robert Emmet (q.v.) also made an unsuccessful attempt in 1803. On May 6, 1882, Lord Cavendish, the newly appointed Secretary for Ireland, and the Undersecretary Burke were murdered in Phoenix Park. Consult: Gilbert, *History of Dublin* (3 vols., Dublin, 1854-59); "Greater Dublin," in *London Municipal Journal* (1889); Gerald, *Picturesque Dublin, Old and New* (London, 1897); Gross, "Dublin," in *Bibliography of British Municipal History* (New York, 1897).

**DUBLIN.** A city and the county seat of Laurens Co., Ga., 54 miles south-southeast of Macon, on the Macon, Dublin, and Savannah, the Central of Georgia, and the Wrightsville and Tennille railroads, and on the Oconee River (Map: Georgia, D 3). It has a Carnegie library. Its chief industries include cotton and oil mills, fertilizer and brickworks, and manufactories of hardwood products, cigars, wagons, and staves. First settled in 1807 and incorporated about 1850, its government, under a charter of 1905, is vested in a mayor, chosen biennially, and a unicameral council. The water works and electric plant are owned by the city. Pop., 1910, 5795.

**DUBLIN.** A city in Erath Co., Tex., 90 miles southwest of Fort Worth, on the Texas Central and the Fort Worth and Rio Grande railroads (Map: Texas, C 3). It is in an agricultural, cotton, and stock-raising country, and has oil mills, cotton compress, flouring mills, creamery, roller mills, and ice and mattress factories. The city owns its water works and sewage system. Pop., 1900, 2370; 1910, 2551.

**DUBLIN, UNIVERSITY OF.** The chief, and for many years the only, institution for higher education in Ireland. The first University of Dublin was established in connection with St. Patrick's Cathedral in 1320, but, lacking an endowment, was never successful and perished, probably at the dissolution of the cathedral foundation by Henry VIII. The present foundation, better known as Trinity College, is unique in having the organization and functions of both a college and a university. In 1591 Queen

Elizabeth issued a charter . . . a college, as "the mother of an . . . with the title of "the College of the Holy and Undivided Trinity, near Dublin." It was expected that other colleges would be formed about this nucleus, and that a university after the English model would gradually rise in the Irish capital. This expectation was, however, disappointed, and though the institution has flourished, it has not been in the way expected. The new foundation received little but its charter from the Queen; the Corporation of Dublin gave to it the grounds and ruins of the suppressed monastery of All Hallows, and a building fund was raised by subscription among the Irish gentry. The first chancellor was William Cecil, Lord Burghley, Elizabeth's great minister, who was also chancellor of Cambridge. The first five provosts were Cambridge men, and by this connection the influence of the English university on the Irish foundation was very strong. The exclusive royal patronage and control by the English crown promised much, but under Elizabeth the college was but poorly supported and led a precarious existence. James I supplied an endowment of some £400 a year as a pension, together with certain estates in Ulster, which insured its future. In 1601 the English troops defeated the Spanish at Kinsale, and in commemoration of their victory subscribed £1800 from the arrears of their pay to establish a library for the college. The two trustees of this fund were Dr. Challoner and Mr., later Archbishop, Ussher. Subsequently the collection of Ussher was with some difficulty purchased by the officers and soldiers of the army of the Commonwealth of Ireland, and from these two unusual contributions the foundation of the present collection was laid. The original constitution of the university, meanwhile, having been found defective, new statutes were framed and issued under the direction of Archbishop Laud in 1637. A considerable part of these are still in force. Under the present system the administration rests in the hands of a board consisting of the provost and senior fellows, in connection with the visitors, a council (since 1874), and the senate. The provost is appointed by the crown and is the chief officer of the college. The board consists of the provost and senior fellows of the college and carries on ordinary college business. The council consists of the provost, four members of the senate chosen by the senior fellows, four by the junior fellows, four by the professors not fellows, and four by the senate at large. The council coöperates with the board in regulating the studies and the appointment of professors. The senate consists of the chancellor, vice chancellor, and all masters and doctors of the university whose names are on its books. The fellows are of two grades, senior and junior. The senior fellows comprise the chief officers of the college; the junior fellows form the bulk of the tutorial force of the college. Fellows, chosen primarily by examination, are promoted by seniority. There is a considerable body of professors, some 40 in all, besides lecturers, and some special instructors. There are 70 scholarships, besides many prizes. As at Cambridge, the old distinctions among the undergraduates still exist. There are four classes of students; noblemen, sons of noblemen, and baronets; fellow commoners; scholars, pensioners, or ordinary students in art; and sizars, or poor students, assisted by the college. Of the last there

are some 30, who obtain their positions by competitive examination. Since 1904 women have been admitted to all classes, examinations, and degrees in arts, medicine, and law.

Entrance to the college is by examination, and there is an additional examination for high places at entrance. The majority of men enter the arts course, but there are courses leading to degrees in music and in engineering, distinct from that in arts. The course of study usually extends over four years and may be an ordinary or an honor course. In the latter, higher requirements are demanded. In each year one term of the three must be "kept" by examination, the others by attendance on lectures or by examination. The required course for the ordinary degree in arts gives the best idea of the . . . First year (junior fres . . . , Greek, Latin, Latin composition, English composition; second year (senior freshman), the same, with the addition of logic and mathematical physics in the second and third terms. The final freshman examination covers all these. In the third year (junior sophister) mathematical physics, logic, and English composition are required throughout the year, astronomy and psychology each for one term, the rest of the work being optional. In the fourth year (senior sophister) astronomy, psychology, and ethics, and English composition are compulsory throughout the year, the rest of the work being optional. The degree examinations cover these as well as the optional work. Men going into the profession of law, medicine, and divinity are allowed to anticipate their professional courses in these last two years. These courses lead to the degree of B.A. For the degree of M.A. a candidate must be a B.A. of at least three years' standing. A doctor of science must be a B.A. of three years' standing, present a thesis, and, if required, pass an examination. The same requirements, in some form or other, apply to all other advanced degrees, in literature, divinity, medicine and surgery, engineering, and music.

The university possesses a number of valuable collections. The library contains over 285 000 volumes. The astronomical observatory of Trinity College is situated at Dunsink, 5 miles from the college. There are, belonging to the college, museums of natural history, astronomy and zoölogy, geology and mineralogy, engineering, pathology, materia medica, and an herbarium, botanical laboratory, and gardens. The grounds of the college in the centre of the city are extensive, the buildings large and handsome. Among the more famous names connected with the institution may be mentioned Archbishop Ussher, Burke, Sheridan, Swift, Goldsmith, Berkeley, and Sir W. Hamilton. The university sends two members to Parliament. Consult: *The Book of Trinity College* (Dublin, 1891-1891); Mahaffy, *An Epoch in Irish History: Trinity College, Its Foundation and Early Fortunes* (London, 1903); *The Irish University Question* by "Catholicus" (ib., 1905); *Dublin University Calendar*.

**DÜBNER**, düb'nër, JOHANN FRIEDRICH (1802-67). A German classical scholar. He was born at Hörsehgau, near Gotha, and, after devoting six years to philological studies at the University of Göttingen, was professor at the Gymnasium at Gotha from 1826 to 1831. During that period he attracted attention by his admirable critical edition of Justin (1831) and by an edition of

Persius. In 1832 he was called to Paris to superintend Didot's new edition of Stephanus' *Thesaurus Linguae Graecae*. Afterward he was employed on Didot's *Bibliotheca Graeca*, to which he contributed the critical editions of Plutarch's *Moralia* (1841); of Maximus Tyrius (1841); of Arrian (1846); and of Himerius (1849); the scholia to Aristophanes (1843) and Theocritus (1849); and the *Anthologia Palatina* (1864). He wrote the commentaries on Horace and Vergil for Didot's *Collection Elzévirienne*; at the request of Napoleon III, prepared a critical edition of Cæsar (1867); and published a number of school editions of the classics. Consult Godefroy, *Notice sur Friedrich Dubner* (Paris, 1867).

**DUBNO**, дубно́. A town in the Russian Government of Volhynia, situated in a marshy region on the Ikva, a little over 30 miles from the Austrian frontier (Map: Russia, C 4). Pop., 1897 (last census), 13,800, mostly Jews.

**DUBOC**, ду'бók', EDUARD (1822-1910). A German author of French extraction, who wrote under the pseudonym "Robert Waldmüller." He was born in Hamburg, the son of Edouard Duboc, author of *Dignité de l'homme*, began a business career, but after spending two years in Italy and Greece turned to literature in 1857, settling in Dresden in 1859. In addition to the tragedy *Brunhild* (1873), the drama *Die Tochter des Präsidenten* (1880), and translations of the poems of François Coppée and of Alfred Tennyson's *Enoch Arden* (1867; 40th ed., 1897) and *In Memoriam* (under the title *Freundesklage*, 5th ed., 1876), he wrote a great number of poems, novels, and romances, some of the more popular of which are: *Unterm Schindeldach*, idyls (1851); *Das Vermächtnis der Millionärin*, a novel (1870); *Walpra*, an elegy (1873); *Leid und Lust*, a novel (1874); *Die Somosierra* (1881); *Darja* (1884); *Felicitas* (1893); *Liebesstürme* (1897). His *Dorfidyllen* are his best poems.

**DUBOC, JULIUS** (1829-1903). A German author and philosopher, brother of Edouard Duboc. He was born in Hamburg and studied law and history in Giessen, Leipzig, and Bonn. His publications include: *Geschichte der englischen Presse* (after Grant, 1873); *Die Psychologie der Liebe* (1874; 2d ed., 1883); *Hundert Jahre Zeitgeist in Deutschland* (1889; part ii, 1893); *Die Frauenfrage in Deutschland* (1892). In addition to these he published a great number of essays, a collection of novelties, *Herzensgeschichten: Ein Novellenstrauss* (1888), the one-act drama entitled *Das Herzensblatt* (published under the pseudonym of "Julius Lanz"), and the drama *Die Freunde* (1902).

**DU BOIS**, du bois'. A borough in Clearfield Co., Pa., 128 miles northeast of Pittsburgh, on the Buffalo and Susquehanna, the Buffalo, Rochester, and Pittsburgh, the Lake Shore and Michigan Southern, and the Pennsylvania railroads (Map: Pennsylvania, D 4). The chief industry of the borough is the mining of bituminous coal, and there are glass and clay works, blast furnaces, large railroad repair shops and a roundhouse, machine shops, a foundry, a tannery, an ice-cream factory, etc. The borough contains a general hospital and owns its water works. Settled in 1873, Dubois was incorporated as a borough in 1881. Pop., 1900, 9375; 1910, 12,623; 1914 (U. S. est.), 14,007.

**DU BOIS, AUGUSTUS JAY** (1849 - ). An

American mechanical and civil engineer, born at Newton Falls, Ohio. He graduated in 1869 at Sheffield Scientific School (Yale), studied for two years (1872-74) at the Mining School of Freiberg (Saxony), and from 1875 to 1877 was professor of civil and mechanical engineering at Lehigh University. In 1877-84 he was professor of mechanical engineering at Sheffield Scientific School and in 1884 was appointed to the chair of civil engineering in the same institution. His publications include: *A New Method of Graphical Statics* (1875-76); a translation and edition of two volumes of Weisbach's *Ingenieur und Maschinen-Mechanik (The Theory of the Steam Engine, 1878)*; a translation of Röntgen's *Warmtheorie (The Principles of Thermodynamics, 1880)*; *The Strains in Framed Structures* (1883; 11th ed., 1900); *The Elements of Mechanics* (3 vols., 1893-95); *Mechanics of Engineering* (2 vols., 1908-09).

**DUBOIS, du'bwä'**, (CLÉMENT-FRANÇOIS) THÉODORE (1837- ). A French organist and composer. He was born at Rosnay, Marne, and, after instruction under local teachers, entered the Paris Conservatory in 1853. His teachers were Marmontel (pianoforte), Benoist (organ), Bazin (harmony), and Ambroise Thomas (fugue and composition). He graduated in 1861, winning the Grand Prix de Rome with his popular cantata *Atala*. His most important appointments were: choirmaster of Sainte-Clotilde; organist at the church of the Madeleine; professor of harmony at the Conservatory (1871); professor of composition at the same institution (1891); and successor of Gounod as chairman of the Academy (1894), and of A. Thomas as director of the Conservatory (1896-1905). He was also elected an officer of the Legion of Honor and made a member of many important foreign orders. He was especially successful in organ composition, possibly because of his brilliancy as an organist, although he also won wide recognition for operatic and orchestral compositions. His more important works are: *Aven Hamet*, a grand opera, produced in 1884; a three-act *Idylle dramatique* (1895); three oratorios—*Les sept paroles du Christ* (1867), *Le paradis perdu* (1878), and *Notre Dame de la Mer* (1897). Among his many other published works are cantatas; several masses; many orchestral works; arrangements for organ, harp, and other instruments; concertos for both organ and violin; and several impressive *a cappella* choruses.

**DUBOIS, EDMOND PAULIN** (1822-91). A French hydrographer and inventor of marine instruments born in Brest. In 1851 he was appointed professor at the Ecole Navale in Brest. His most important inventions are a gyroscope and a compass equipped with a double needle to determine the deflection caused by the iron-work of a vessel. In addition to contributions on astronomy and hydrography to scientific magazines, he published the following important works: *Cours d'astronomie* (1855; 3d ed., 1876); *Etude historique et philosophique sur le mouvement du globe* (1861); *Cours de navigation et d'hydrographie* (2d ed., 1869); *De la déviation des compas à bord des navires* (1867); *Les passages de Vénus sur le disque solaire* (1883); *Résumé analytique de la théorie des marées* (1885); *Cercle nautique* (1888). In 1865 he translated Gauss's *Theoria motus corporum* into French with notes.

**DUBOIS, GUILLAUME** (1656-1723). A cardinal and prime minister of France. He was

born at Brives-la-Gaillarde, the son of a country doctor, and was educated at the Collège Saint-Michel in Paris. Appointed tutor to the young Duc de Chartres (the future Duke of Orléans), he gained great influence over his pupil, whose constant companion he was in peace and in war, and whose marriage to Mademoiselle de Blois, a natural daughter of Louis XIV, Dubois brought about. His political career began in 1701, when he was made Secretary to the French Embassy at London. In 1715 he became private secretary to his pupil, now the Regent, and quickly made himself the virtual ruler of France. The key of his foreign policy was the bringing of Philip of Spain's ambition and the overthrow of Philip's Minister, Alberoni. Dubois effected this by means of the famous union of England, France, and Holland in the Triple Alliance (1717), later changed to a Quadruple Alliance by the accession of Austria. This coalition worked a revolution in French policy, since by the new arrangement friendship was made with England, an ancient enemy, and enmity declared against an old ally, Spain. The last years of Dubois were filled with great labors and high honors. In rapid succession he became Archbishop of Cambrai (1720), Cardinal (1721), and Prime Minister (1722). He died Aug. 10, 1723. Dubois has been portrayed by his enemy, Saint-Simon, as a deformed and debauched pander to the Regent. It is known now that malice has darkened the picture, though Dubois was by no means an exemplary citizen or statesman. The political genius of the man, however, can hardly be denied. Consult: *Savignac, Mémoires secrets et correspondance inédite du cardinal Dubois* (Paris, 1815); *Capefigue, Le cardinal Dubois* (ib., 1861); and for a treatment of Dubois's foreign policy, Wiesner, *Le régent, l'abbé Dubois et les Anglais* (ib., 1891).

**DUBOIS, JEAN ANTOINE** (1765-1848). A French missionary in the East Indies, born at Saint-Raméze, Ardèche. He wrote several books concerning India, the best known of which is the *Descriptions of the Character, Manners, and Customs of the People of India, and of their Institutions, Religious and Civil* (1816), a standard work which was brought out in a new edition in London in 1900.

**DUBOIS, LOUIS** (1830-80). A Belgian painter. He was born in Brussels and studied under Couture in Paris. His paintings, which strongly suggest the influence of Courbet, are full of animation and a coloring which at times strikingly reminds one of the brilliancy of Jordaens and Frans Hals. In the choice of subjects Dubois reveals versatility, while his treatment of them entitles him to be ranked among the most prominent representatives of the realistic school. His subjects are portraits, landscapes, marines, animal and genre pictures, and still life. His works are of unequal merit, the earliest being considered the best. They include: "Priest Preparing for Mass" (1857); "The Storks" (1858) and "Landscape with Dead Roe" (1863), both in the Modern Gallery, Brussels; "Rice Eater" (1872); "Billiard Player" (1878); "The Meuse near Dordrecht."

**DUBOIS, PAUL** (1829-1905). A French sculptor and painter. He was born at Nogent-sur-Seine (Aube), and after studying law for several years he spent two years in the atelier of the sculptor Toussaint, and from 1859 to 1862 was in Italy. In 1863 he achieved success with "St. John the Baptist" (Luxembourg). The

most popular of his earlier works, "The Florentine Minstrel" (also in the Luxembourg), won a medal of honor in 1865 and shows Dubois's study of Renaissance models. His monument to General Lamoricière, in the cathedral at Nantes, received the medal of honor at the Exposition of 1878. It is designed in Renaissance style and decorated with statue and bas-reliefs. His other works in sculpture include a "Virgin and Child" (1867, Church of the Trinité, Paris); "Birth of Eve" (1873); a figure of "Grief" for his father's tomb at Nogent-sur-Seine; "Narcissus" and "The Remembrance" (Luxembourg); an equestrian statue of the Constable de Montmorency (1886, castle of Chantilly); a statue of Jeanne d'Arc (1889) for the city of Rheims—the most popular of all his works—which had the honor of a commemorative medal; "Alsace and Lorraine" (1900), a replica of which he had finished just before his death; and portrait busts of Pasteur, Baudry, Gounod, Henner, and others. He is especially well represented in the Ny-Carlsberg Glyptotek, Copenhagen. Dubois is one of the most important figures in French sculpture of the nineteenth century. He is the foremost representative of the Renaissance influence as distinguished from the classic. His work is characterized by infallible good taste, subtle workmanship, and high perfection of detail. Among other honors he received the grand cross of the Legion of Honor (1896) and was a member of the Institute. He was conservator of the Luxembourg (1873-78) and director of the Ecole des Beaux-Arts from 1878 until his death. His work as a painter is mostly in portraiture, and a notable example of it is "My Children" (1876)—both in color and drawing an admirable work. Consult Brownell, *French Art* (New York, 1892).

**DUBOIS, PAUL.** See PAUL-DUBOIS, LOUIS FRANÇOIS ALPHONSE.

**DU BOIS, du-bois', WILLIAM EWING** (1810-81). An American numismatist, born at Doylestown, Pa. He was assistant assayer in the United States Mint in Philadelphia, Pa., from 1836, and chief assayer from 1872. In addition to accumulating the comprehensive and important coin collection at the mint he published a *Manual of Gold and Silver Coins of All Nations* (1842-51).

**DU BOIS-REYMOND, du bwä'rä'môn', EMIL HEINRICH** (1818-96). A German physiologist, born in Berlin. He was educated at the College of Neuchâtel and became a theological student at the University of Berlin, but, under the influence of Mitscherlich, soon abandoned theology to devote himself to chemistry, natural philosophy, mathematics, and geology. Dr. Edward Hallmann finally directed him towards medicine, and he became a pupil of Johannes Müller, the famous anatomist and physiologist. In 1841 young Du Bois-Reymond undertook to solve the problems of animal electricity proposed by Matteucci and Nobili and entered upon the experimental work which he prosecuted for 40 years. An extensive account of his first researches, with a description of the immense number of experiments made, largely by new methods and with apparatus of his own invention, appeared under the title *Untersuchungen über tierische Elektrizität* (2 vols., 1848-49). Previous attempts to observe electrical phenomena during the contraction of muscle had failed, and Du Bois-Reymond was the first to



suggest tetanizing muscles in order to obtain an increased duration of contraction for observation. He discovered how to cause deflection of the magnetic needle by the voluntary contraction of living muscle; demonstrated electric phenomena in a tetanized nerve; caused a deflection of the needle of the galvanometer by molecular change, accompanying nerve currents; and showed that "negative variation" is transmitted in a motor nerve from periphery to centre and in a sensory nerve from centre to periphery. In 1848 Du Bois-Reymond was elected a member of the Royal Academy of Sciences of Berlin. In 1858, upon the death of Johannes Müller, he succeeded to the chair of physiology in the University of Berlin and became director of the laboratory. In 1867 he became permanent secretary of the Academy of Sciences of Berlin and later was made Imperial Privy Councillor. Several of his experimental and practical researches were in the domain of electricity without reference to physiology. These include his important investigations of the aperiodic state of the magnetic needle induced by high dampening powers. He invented the method of reading messages over the Atlantic cable by watching the beam of light reflected from a mirror attached to the needle of a galvanometer. He demonstrated, controverting Berzelius and Liebig, that the reaction of muscle substance at rest is neutral or slightly alkaline, and acid after death, while in the act of contraction acid is evolved. Du Bois-Reymond was a very successful teacher, and a popular lecturer in German, French, and English. He ranks, with Helmholtz and Virchow, as one of the greatest scientists Germany ever produced, his researches having laid the foundation of all our true knowledge in connection with animal electricity, and his observations forming permanent scientific material. Prof. Burdon Sanderson remarked of him, "Du Bois-Reymond probably never made an incorrect observation or performed a faulty experiment." Besides the works mentioned, he published: *Ueber die Grenzen des Naturkennens* (6th ed., 1884); *Gesammelte Abhandlungen zur allgemeinen Muskel- und Nervenphysik* (2 vols., 1875-77); *Reden* (2 vols., 1886-87). His *Vorlesungen über die Physik des organischen Stoffwechsels* were published posthumously (1899). Consult Engelmann, *Gedächtnisrede auf Emil Du Bois-Reymond* (Berlin, 1898), and Stirling, "E. Du Bois Reymond," in the *Medical Chronicle*, January, 1897 (London, 1897).

**DU BOIS-REYMOND, PAUL** (1831-89). A German mathematician, brother of Emil Du Bois-Reymond. He was born in Berlin, studied medicine in Zurich, and afterward went to Königsberg, where he devoted himself to physics and mathematics. In 1865 he became lecturer in mathematics at Heidelberg and was appointed professor of mathematics at Freiburg (1870), Tübingen (1874), and in the Berlin Technological Institute (1884). His mathematical work was chiefly on differential equations, series, and the theory of functions. His *Abhandlung über die Darstellung der Funktionen durch trigonometrische Reihen* (1876) and his *Zwei Abhandlungen über unendliche und trigonometrische Reihen* (1871; 1874) have been edited by Jourdain (Leipzig, 1913).

**DUBOSARY**, dōō'bōs-sā'rē, or **NOVIE DUBOS-**

**SARY**. A town in the Russian Government of Kherson, situated on the Dniester, 85 miles northwest of Odessa (Map: Russia, C 5). It has some trade in tobacco, wine, grain, and other agricultural products of the surrounding district. The town was founded at the end of the eighteenth century. Pop., 1897 (last census), 13,200, consisting of Moldavians, Russians, and Jews.

**DUBOSC**, du'bōsk'. The highwayman for whose crime Lesurques is arrested, in *The Lyons Mail* (1854) by Charles Reade, adapted from the French *Courrier de Lyons* by Moreau, Siraudin, and Delacour (Paris, 1850). Sir Henry Irving assumed this double rôle with great success.

**DU BOSE, WILLIAM PORCHER** (1836- ). An American theologian, born at Winnsboro, S. C. He studied at South Carolina Military Academy, the University of Virginia, and the Theological Seminary of South Carolina. During the Civil War he was chaplain of Kershaw's Brigade in the Confederate army. Ordained in 1865 a priest in the Protestant Episcopal church, he served as rector of St. John's Church, Winnsboro (1866-67) and of Trinity Church, Abbeville, S. C. (1868-71). From 1871 to 1894 he was chaplain and professor of ethics and New and Old Testament language and interpretation at the University of the South; from 1894 to 1908 he held the chair of New Testament language and interpretation and was dean of the divinity department. His writings include: *The Principles of the New Testament* (1892; new ed., 1906); *The Ecumenical Councils* (1896); *The Gospel in the Gospels* (1906); *The Gospel According to St. Paul* (1907); *High-Priesthood and Sacrifice* (1908); *The Reason of Life* (1911); *Turning Point in my Life* (1912).

**DUBOST, ANTONIN** (1844- ). A French politician, born at Arlesles, Rhône. For a time he was a contributor to *La Marseillaise*. He held various offices, becoming secretary general of the prefecture of police in 1870, préfet of Orne in 1871, Councilor of State in 1879, president of the general council of Isère in 1893, and Minister of Justice in the Casimir-Perier cabinet of 1893-94. In 1897 he became a senator and in 1906 was elected President of the Senate. He pointed out to the government the bad effects of the teaching of the Catholic clergy as tending to turn their pupils against the Republic. He wrote the valuable historical works: *Les suspects en 1858* (1867); *Les conditions du gouvernement en France* (1879); *Danton et la politique contemporaine* (1880); *Danton et les massacres de septembre* (1885).

**DUBOVKA**, dōō-bōv'kā. A river port in the Russian Government of Saratov, situated on the right bank of the Volga, about 30 miles above Tzaritzin (Map: Russia, F 5). Formerly a place of considerable trade in agricultural products, Dubovka had lost its commercial importance since the completion of the railway line connecting Kalach on the Don and Tzaritzin on the Volga. Pop., 1897 (last census), 16,900.

**DUBS**, dōōps, JAKOB (1822-79). A Swiss statesman. He studied law at Heidelberg, Bern, and Zurich; held several official positions in his native canton; was elected a member and in 1857 president of the Federal Court; and in 1864 and 1868 was elected President of the Confederation. In politics he was liberal and progressive. Among his publications are *Die*



*Schweizer Demokratie, in ihrer Entwicklung* (1866), and the valuable *Das politische Recht der schweizerischen Eidgenossenschaft* (1877-78).

**DUBUC',** SIR JOSEPH (1840-1913). A Canadian jurist. He was born at St. Martine, P. Q., and was educated at Montreal College and McGill University. He studied law, and was called to the bar of Quebec in 1869, and, after removing to Winnipeg, was called to the Manitoba bar in 1871. He was elected a Conservative member of the Manitoba Legislature in 1870 and in 1875-78 was Speaker of that body. He was also appointed a member of the Executive Council of the Northwest Territories in 1872, and in 1874 he was its legal adviser. When Manitoba University was founded, in 1878, he became one of its councillors, and in 1888 he was appointed its vice chancellor, retaining both these positions until his death. He was also superintendent of the Roman Catholic section of the Manitoba Board of Education. In 1879 he was appointed a puisne judge of the Court of Queen's Bench, and in 1903 he became Chief Justice, an office from which he retired in 1910. In 1912 he was knighted.

**DUBUFE,** du'bu'f', EDOUARD (1820-83). A French portrait and figure painter, born in Paris. He was a pupil of his father, Claude Marie Dubufe, and of Paul Delaroche, and his earlier works were mostly religious. His chief success, however, was in portrait painting, to which he afterward confined himself. His works were well drawn, and their good finish, together with their smooth and elegant coloring, made them popular, especially among ladies of rank. Among his sitters were the Empress Eugénie (1853), Rosa Bonheur (1857), the Princess Mathilde (1861), and the Marquise de Gallifet. Among his portraits of men, which are better than those of women, were those of Gounod (1867), Dumas fils (1873), Emile Augier (1876), and Philippe Rousseau (Louvre). Besides his portrait, the best known of his paintings are "The Peace Congress of 1856 at Paris" (1857, in the Gallery of Versailles), and a theatrical representation of the "Prodigal Son" (1866), in the manner of Paul Veronese. He was made Chevalier of the Legion of Honor in 1853 and officer in 1869 and received a first-class medal in the Salon of 1844.

**DUBUFE,** EDOUARD MARIE GUILLAUME (1853-1909). A French decorative painter, born in Paris. He was the pupil of his father, Edouard Dubufe, and of Mazerolle. His works include figures and portraits, but he is especially known by his large allegorical paintings, which are warm in color and executed with freedom and skill in design, but without much force. Notable among these are his "Sacred and Profane Music" (Amiens Museum), and "The Trinity of Poets." He decorated with great elegance the ceiling of the foyer of the Comédie Française (the sketch of which is in the Luxembourg), portions of the Hôtel de Ville, of the Salle des Fêtes, Palais de l'Élysée, and the new Sorbonne. He received a first-class medal in 1889 and was made an officer of the Legion of Honor in 1900. He died at sea on a voyage to Buenos Aires.

**DUBUQUE,** du-buk'. A city, port of entry, and the county seat of Dubuque Co., Iowa, 167 miles by rail west by north of Chicago, Ill., and 205 miles northeast of Des Moines, on the west bank of the Mississippi River, and on the Chicago Great Western, the Illinois Central,

the Chicago, Burlington, and Quincy, and the Chicago, Milwaukee, and St. Paul railroads (Map: Iowa, G 2). It has communication by boat with other points on the river and is connected with the opposite shore by three bridges, one of which, 2000 feet long and 50 feet above high water, cost \$135,000. Dubuque is built on and at the foot of picturesque bluffs. The business district occupies the lower level and is regularly laid out with broad streets. The city contains the Carnegie-Stout library; a fine United States government building, including the post office, customhouse, Federal courts, etc.; seven asylums and hospitals; a sanitarium; Earl Point Park; and many educational institutions, among which are St. Joseph's College and Mount St. Joseph's Academy (Roman Catholic), Wartburg Seminary (Lutheran), the German Presbyterian Theological School of the Northwest, and the Iowa Institute of Science and Arts. Dubuque is an important market for agricultural produce and the centre of a large wholesale and jobbing trade and of the lead and zinc mining industry of the Northwest. It has railway repair shops, enamel works, flouring and lumber mills, pork-packing houses, iron and brass foundries, breweries, and manufactures of boots and shoes, carriages and wagons, agricultural implements, hardware, leather, furniture, toys, notions, bricks, oils, engines, boilers, steel ship hulls, barrels, brooms, pearl buttons, sashes, doors, blind, etc. Some war vessels for the government have been constructed at Dubuque. The annual income and expenditures of the city in 1912 were \$923,000 and \$849,000 respectively; the principal items of expense being \$44,000 for the fire and \$36,000 for the police departments and \$126,000 for schools. The oldest city in the State, Dubuque, was named in honor of Julien Dubuque, a French-Canadian who settled there in 1788 and to whom a monument has been erected. The first permanent settlement dates from 1833; four years later it was incorporated as a town, and in 1840 it was chartered as a city. Pop., 1890, 30,311; 1900, 36,297; 1910, 38,494; 1914 (U. S. est.), 39,428.

**DUC,** duk, JOSEPH LOUIS (1802-79). A French architect, born in Paris, and a pupil of Percier at the Ecole des Beaux-Arts. He won the Prix de Rome in 1825. With Dubau and Labrousse he helped to initiate the so-called néo-Grec movement in architecture and was early chosen with Alavoine to design the Column of July in the Place de la Bastille (1840). In 1854 he and the architect Dommey began to enlarge and rebuild the Palais de Justice, to which he devoted the remainder of his life. Upon its completion Napoleon III presented him with a prize of 100,000 francs, a portion of which the architect set aside to establish a biennial prize for high studies in architecture. He was made a member of the Institute in 1866 and inspector general of all civil buildings in 1871. His other works include the monuments to Duban and Henri Cahieux.

**DU CAMP,** du kãn', MAXIME (1822-94). A French author, born in Paris. His more important books are *Paris: ses organes, ses fonctions, sa vie* (6 vols., 1869-75) and a history of the Commune, *Les convulsions de Paris* (4 vols., 1878-79). His poems are gathered in *Les chants modernes* (1855) and *Les convictions* (1858). His best novel is *Mémoires d'un suicide* (1853). He wrote also a life of Théophile

Gauthier (1890), which contains most valuable and information concerning the famous and their Cénacle; was one of the founders of the *Revue de Paris* (1851-58) and a frequent contributor to the *Revue des Deux Mondes*. Consult P. Bonnefon, "Maxime du Camp et les Saint Simoniens," in *Revue d'Histoire Littéraire de la France* (1910).

**DU CANGE**, du kânzh, CHARLES DU FRESNE (1610-88). A French scholar, one of the greatest of the seventeenth century, born at Amiens. He became government treasurer in his native town, but devoted his entire life to the study of the Middle Ages. After 1668 he lived in Paris, where he devoted himself to the study of original documents of all sorts. He displayed almost incredible industry, profound linguistic attainments, accurate knowledge in many fields, and critical insight. He is best known for his great *Glossarium ad Scriptores Mediæ et Infimæ Latinitatis*, published in 3 vols. in Paris in 1678, a veritable treasure of industry and erudition. It went through many editions, always with an increase of subject matter, and was last published in 10 vols. by Favre (Niort, 1884-87). It is the standard work on mediæval Latin. Du Cange planned a similar work for mediæval Greek and published the *Glossarium Mediæ et Infimæ Græcitatatis*, on a less extensive scale, in Lyons in 1688, the year of his death. He edited several Byzantine historians, with Latin translations, as: *Paulus Silentiarius* (1670); *Zonaras* (1687); *Nicephorus Gregoras* (published posthumously in 1702); the *Chronicon Paschale sive Aleandrinum* in 1688. Nor were his studies confined to the mediæval Greek and Latin writers. Among his many other works were *Histoire de l'empire de Constantinople sous les empereurs français* (1657) and *Histoire de l'état de la ville d'Amiens, et de ses comtes*, found among his papers and published in 1841. Consult Fougère, *Essai sur la vie et les ouvrages de Du Cange* (Paris, 1852), and Sandys, *A History of Classical Scholarship*, vol. ii (Cambridge, 1908).

**DUCAS**. See JOHN III, VATATZES.

**DUCAS**, dō'kās (Lat., from Gk. Δούκας, *Doukas*), MICHAEL. A Greek historian who lived in the fifteenth century. He belonged to the Imperial family of the same name at Constantinople. He wrote a *History of the Fall of the Byzantine Empire* (ed. by Bekker for the Bonn series of Byzantine historians, 1834), which is important for the period from the death of John Paleologus I (1355) to the capture of Lesbos in 1482.

**DUCASSE**, du'kās', JEAN BAPTISTE (1646-1715). A French naval officer, born at Saubusse. He entered the service of the West Indies Company and later of the Senegal Company, for whom he practically created the Colony of Senegal. He afterward entered the royal navy, in which he rose to be captain. In 1691 he was appointed Governor of Santo Domingo. He administered the affairs of the colony with great skill and conducted a successful defense against an invasion by the English and Spanish during the War of the League of Augsburg. In 1697 he commanded the land forces in the capture of Cartagena and in 1702, after a four days' fight, defeated a superior English fleet under Admiral Benbow. Being deputed in 1705 to aid Philip V in the War of the Spanish Succession, he kept open

the very necessary communication with the Indies. With the rank of lieutenant general of naval forces, he directed the blockade of Barcelona in 1714.

**DUCAT**. A name formerly used throughout Europe for coins of different value, mostly of gold. Ducats were first struck by the Byzantine emperors in the eleventh century, or, according to some authorities, a century later, in Sicily. The name is said to have originated from the legend found on early Sicilian pieces, *Sit tibi, Christe, datus, quem tu regis, iste Ducatus* ('Be intrusted to thee, Christ, this duchy (*Ducatus*) of which Thou art ruler'). Especially famous were the golden ducats of Venice, known as *zecchini*, or sequins. Later, Holland, the German Empire, Russia, and the states of the north began the striking of ducats. At present there are practically none of these coins in existence outside of collectors' cabinets. The value of the principal ducats formerly in circulation ranged from \$1.46 for the Venetian to \$2.32 for the Spanish and Hanoverian coin; the usual value was \$2.32. Venice and the Two Sicilies struck also silver ducats of the value of \$0.83 approximately, and Spain issued silver ducats varying in value from \$0.90 to \$1.10. In Austria-Hungary gold ducats are still coined, chiefly for the purposes of foreign trade, especially in the Levant. Quadruple ducats also are struck.

**DUCCIO**, dōō'chō, properly DUCCIO DI BUONINSEGNA (c.1255-1319). A Siennese painter, after Giotto the foremost artist of mediæval Italy. He was born at Siena, where he passed nearly all of his life. According to Weigeld, he was probably a pupil of Guido da Siena, but Berenson and others believe that he studied with some Byzantine master, perhaps at Constantinople itself. The details of our meagre knowledge of his life are due chiefly to excerpts from the public records of Siena published by Lancini in 1898. The entries concerning Duccio begin with 1278 and are mainly of two kinds: payments for paintings executed for the city, largely covers of muniment books, "cassone" fronts, and the like; and fines, chiefly for remiss payment of debts, but occasionally for neglect of military or civic duty. On one occasion (1286) he was fined 100 pounds for a serious offense, the nature of which is not known. In 1285 he contracted with the Company of St. Mary in Florence to paint a Madonna for their chapel in Santa Maria Novella. The commission was probably executed in Florence, and the painting is generally identified by recent critics with the Ruccellai Madonna, formerly attributed to Cimabue—the masterpiece of his early period. In 1298 he was a member of the official board of the great council of Siena; in 1302 he painted a "Majestas" (now lost) for the chapel of the town hall; in 1308 he received from Jacomo Mariscotti, master of the works of the cathedral, the commission for a great altarpiece of the cathedral—an incomparable masterpiece, probably the finest of its kind ever painted. The front panel, 14 feet long and 7 feet high, is a "Majestas"—a Madonna enthroned and surrounded by a host of angels, saints, and the Apostles. The Gothic suffix contains eight scenes of the life of Mary. The reverse of the large panel contains 26 scenes from the life of Christ, painted on a golden background, with eight in the suffix representing Christ after the resurrection. The predella were painted on both sides with scenes from the life

of Christ, some of which are now in the galleries of the Berlin Museum, the Benson collection, and the National Museum, London. On its completion in 1311 the altar was borne in solemn procession to its place under the cupola of the cathedral by the clergy, the officials of the city, and all the people of Siena. It remained in place until 1506, when it was removed from the cathedral, and separated; the greater part, fortunately, is still in the museum of the cathedral. Although liberally rewarded both on this and on other occasions, and recorded as the possessor of a house in Siena and a vineyard near the city, Duccio, like many artists since then, seems to have been in constant financial difficulties. On Aug. 3, 1319, his heirs, six sons and one daughter, renounced their debt-encumbered inheritance—from which it is evident that the artist died shortly before.

Duccio's art represents the culmination of Italo-Byzantine painting. Unlike his younger contemporary, Giotto (q.v.), whose art marks the beginning of a new epoch, he was a conservative, who perfected the old. Confining himself to its prescribed formulas, he nevertheless embodied in his best work sublime conceptions and great depth of feeling. An incomparable illustrator, he tells his stories with simplicity and directness. His panels have marvelous decorative qualities, and their general effect is not unlike that of mosaics which time has bronzed. Judged from the same decorative standpoint, his line is dignified, his composition always excellent. Like all Byzantine representations, his paintings are deficient in life and movement. The style which he established was determinative for the development of the Sienese school, of which he is the real founder. What, then, was the influence which enabled him thus to perfect Italo-Byzantine art? According to Wulff, it was the French Gothic, while Weigeld thinks his improvements due to the independent study of nature. But insufficient evidence supports both hypotheses, and it seems more probable that he was under the direct influence of genuine Byzantine art, which shortly before this time experienced a great revival in the mother land. He may have acquired it from the study of Byzantine miniatures, enamels, small mosaics, and ivories, in which Italy then abounded or, as Berenson thinks, from direct training under a Byzantine master.

There is great diversity of opinion concerning the authenticity of pictures, besides those mentioned above, ascribed to Duccio. Authorities are generally agreed that the "Madonna with the Three Franciscans," a "Madonna with Four Saints," and a third Madonna in the Academy of Siena are by him. Other unquestioned works are a triptych in the National Gallery, London, a "Crucifixion" in Buckingham Palace, and Madonnas in the Gallery of Perugia and the Stroganoff collection, Rome. To these Berenson adds several others at Siena, which Weigeld considers school pieces. There is also diversity of opinion concerning a fine triptych of the "Crucifixion" in the J. P. Morgan collection, New York.

**Bibliography.** The principal authority is Weigeld, *Duccio di Buoninsegna* (Leipzig, 1911); but his work is by no means final. For an admirable appreciation of Duccio, consult Berenson, *Central Italian Painters of the Renaissance* (London, 1913). Consult also

Wulff, *Repertorium für Kunstgeschichte* (1907), and the notes to the new editions of Crowe and Cavalcasell, *History of Painting in Italy*, by Douglas (London, 1908), and Hutton (ib., 1909).

**DU CERCEAU**, du sâr'sô'. See ANDROUET DU CERCEAU.

**DU CEY**, THOMAS JAMES (1843-1909). An American Catholic clergyman. He was born at Lismore, Ireland, was brought to the United States in 1848, and was educated at the College of St. Francis Xavier, New York City. In 1880 he became pastor of St. Leo's Church, which was founded by him in that year. He was widely known as a promoter of civic reform. He . . . . . sums of money upon his church, in . . . . . with which a building called St. Leo's Repose for the Dead was established in 1899 as a temporary resting place for the bodies of . . . . . lie in New York City.

**DU CHAILLU**, du shâ'yû', PAUL BELLONI (1835-1903). An African explorer and author. He was born in New Orleans, La., of French Huguenot parentage, and was educated in Paris. He went at an early age to Africa, where his father was established as a trader in the Gabon country. Young Du Chaillu familiarized himself with the language and customs of the neighboring coast tribes, and after three years spent in America set out, in 1855, upon an exploring expedition into the interior of equatorial Africa. He spent nearly four years in his explorations, and his discoveries added greatly to the knowledge of the flora and fauna of Africa, although, because of their rather remarkable character, the truth of his accounts was scouted by scientists at the time. Besides being the first white man to observe and obtain specimens of the gorilla, he secured 60 hitherto unknown species of birds and accumulated much valuable information as to the life and customs of the almost unknown tribes of pygmies in the interior of the continent. His published account of his explorations and discoveries, *Explorations and Adventures in Equatorial Africa* (1861), met with a storm of ridicule and refutation. In order further to substantiate his statements, he made a second journey into equatorial Africa in 1863, where he remained until 1865 and added to his previous discoveries. His experiences on his second expedition are detailed in *A Journey to Ashang Land* (1867). In 1872-73 he made explorations in Norway, Sweden, Lapland, and Finland, and in 1898-1902 traveled through Russia. His published works, besides those named above, include: *The Gorilla Country* (1868); *Wild Life under the Equator* (1869); *Lost in the Jungle* (1869); *My Apingi Kingdom* (1870); *The Country of the Dwarfs* (1870); *The Land of the Midnight Sun* (1881); *The Viking Age* (2 vols., 1889); *The Land of the Long Night* (1900); *The World of the Great Forest* (1900).

**DUCHATEL**, du'shâ'têl', CHARLES MARIE TANNEGUY, COUNT (1803-67). A French statesman, born in Paris. He was Minister of Agriculture and Commerce in 1834-36, Minister of Finance in 1836-37, and Minister of the Interior in 1839-48. His most important work, based upon a careful study of the theories of Malthus, is entitled *Traité de la charité dans ses rapports avec l'état moral* (1829; 2d ed., under the title *Considérations d'économie politique*). The *Documents statistiques sur la*

*France* (1834) are valuable. The principal achievement of Duchatel as a legislator was the complete reformation of the tariff laws.

**DUCHÉ**, du'shâ', JACOB (1737-98). An American clergyman and writer. He was born in Philadelphia, of Huguenot parentage; was a member of the first class which graduated (1757) at the College of Philadelphia (now the University of Pennsylvania); studied for a time at Cambridge University, England, and in 1775 became rector of the united parishes of Christ Church and St. Peter's, Philadelphia. On the approach of the Revolutionary War he joined the Whig or Patriot party, and on Sept. 7, 1774, made the opening prayer before the Continental Congress, then assembled in Carpenter's Hall, Philadelphia. For three months after the passage of the Declaration of Independence he acted as chaplain to Congress, but when the English gained possession of Philadelphia, he abandoned the Whig cause and in October, 1777, wrote his well-known letter to Washington, urging him "to represent to Congress the indispensable necessity of rescinding the hasty and ill-advised Declaration of Independency" and, that failing, to "negotiate for your country at the head of your army." The letter becoming public, and much indignation being aroused against Duché, he went to England, where he soon attracted attention by his eloquence, and acted as chaplain to the Lambeth Orphan Asylum until 1790, when he came back to Philadelphia. Besides a number of occasional sermons, he published *Observations on a Variety of Subjects, Literary, Moral, and Religious, in a Series of Letters written by a Gentleman of Foreign Extraction, who resided some Time in Philadelphia* (Philadelphia, 1774), a book of some merit which became widely popular, was frequently republished, and is best known under the title *Caspipina's Letters*. He also published *Discourses on Various Subjects* (London, 1779), which passed into several editions. Consult a brief sketch in Tyler, *Literary History of the American Revolution* (New York, 1897).

**DUCHENNE**, du'shên', GUILLAUME BENJAMIN AMAND (1806-75). A French physician, called "Duchenne de Boulogne," born at Boulogne-sur-Mer, and educated in Paris. Here he became established in 1842 and soon acquired fame as an investigator in electric diagnosis and electrotherapeutics, of which science he is sometimes considered the founder. He was a pioneer in the localization of the electric current and its adaptation in determining the physiology of the various muscles of the body. Scarcely less important were his researches on the pathology of the nervous system. His numerous publications include: *De l'électrisation localisée et de son application à la pathologie et à la thérapeutique* (1855; 3d ed., 1872); *Mécanisme de la physiologie humaine, ou analyse de l'expression des passions* (1862); *Physiologie des mouvements* (1867).

**DUCHESNE**, du'shân', ANDRÉ (in Latin, ANDREAS CHESNIUS, DUCHENUS, or QUERCETANUS) (1584-1640). A French historian, sometimes called the "Father of French History." He was born in Touraine and studied in London and Paris. Under Richelieu's ministry he was appointed royal geographer and historiographer. Among his writings were: *Historie Normannorum Scrip-*

*tores Antiqui* (1619); *Histoire des rois, ducs, et comtes de Bourgogne* (2 vols., 1619-28); *Histoire généalogique de la maison de Montmorency et de Laval* (1624); *Histoire généalogique de la maison de Vergy* (1625); *Histoire généalogique de la maison de Guiches* (1631); *Historia Francorum Scriptores Coetanei ab ipsius Gentis Origine ad Philippi IV Tempora* (5 vols., 1636-49; vols. iii-v were written by his son, François Duchesne).

**DUCHESNE**, JACQUES CHARLES RENÉ ACHILLE (1837- ). A French soldier. He was born in Sens, France. He distinguished himself in the Franco-Prussian War in 1870-71, in Tongking in 1883, became a general of brigade in 1888 and of division in 1893, and in 1895 was commandant of the expedition which conquered Madagascar. He became general of division and a member of the Superior Council of War (1900). Consult his elaborate official *Rapport* (Paris, 1897) on the Madagascar campaign.

**DUCHESNE**, LOUIS MARIE OLIVIER (1843- ). A French Catholic scholar, born in Saint-Servan, Brittany, the son of a sea captain. He traveled in the East in 1874 and 1876, and in 1877-85, after studying with De Rossi and receiving the degree of Litt.D. for a thesis on the *Liber Pontificalis* (a remarkable piece of critical analysis), he taught Church history in the Catholic Institute, from which he went to the Ecole Pratique des Hautes Études and then to the French school at Rome as its director. In January, 1911, he was elected to the French Academy to succeed Cardinal Mathieu. He was president of a papal commission appointed in 1902 to consider the revision of the breviary. He edited the *Liber Pontificalis* (1886-92) and wrote *Origines du culte chrétien* (1889; Eng. trans. by McClure, *Christian Worship*, 1902), *Fastes épiscopaux dans l'ancienne Gaule* (1894-99), *Histoire ancienne de l'église* (1906 et seq.; Eng. trans., 1909-13, *Early History of the Christian Church*), which was put on the Index, and many articles for the *Bulletin critique*,—which he founded to popularize his critical treatment of church history.

**DUCHESNE**, PÈRE. See HÉBERT, JACQUES RENÉ.

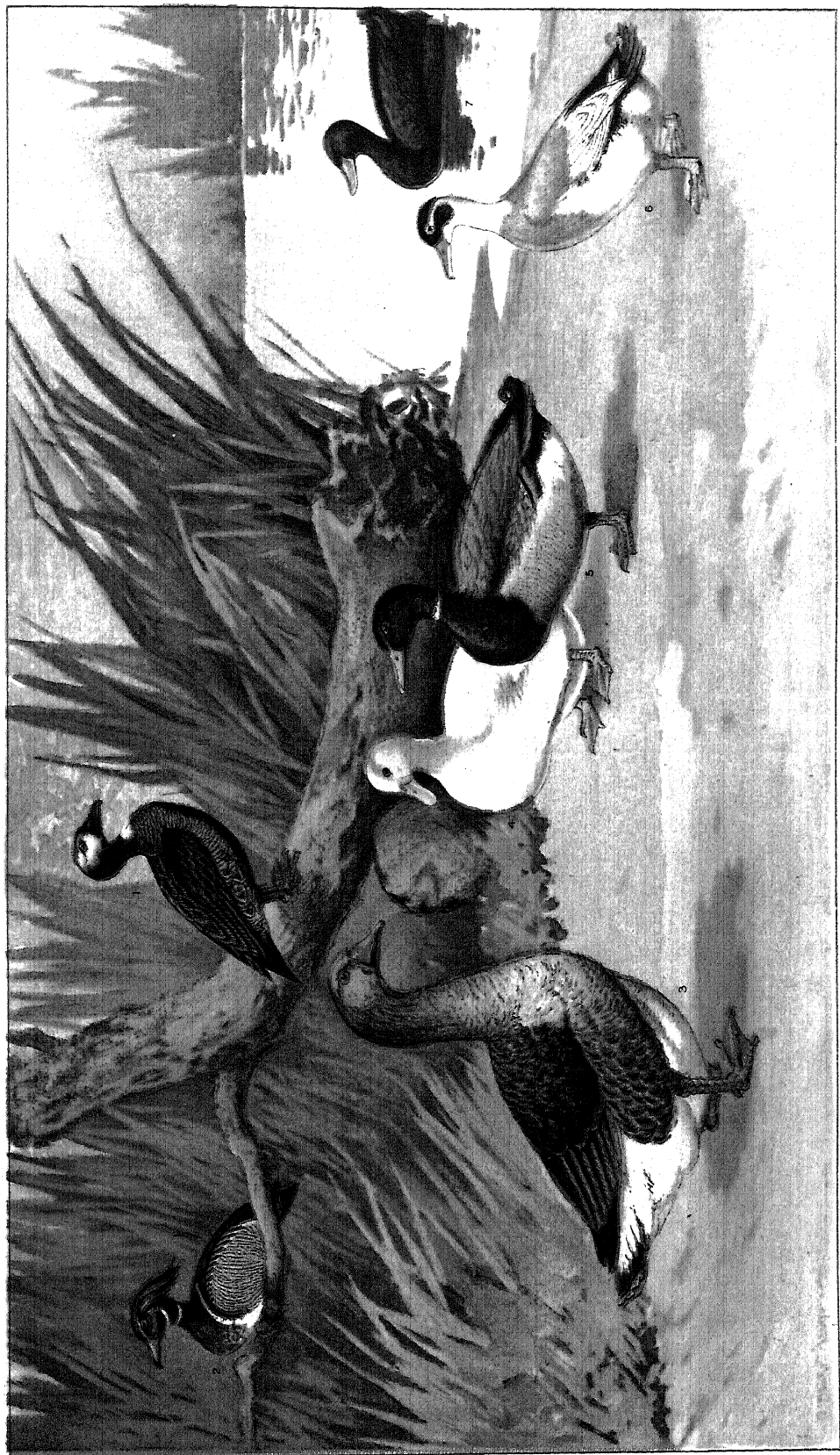
**DUCHESNOIS**, du'shâ'nwä', CATHERINE JOSÉPHINE (properly RAFIN) (1777-1835). A French actress, born at Saint-Saulves (Nord). She made her début at the Comédie Française in Racine's *Phèdre*. She was received with enthusiasm and for five years was the favorite of the Parisian public. Then the beautiful Mademoiselle Georges appeared, and the two actresses began an active rivalry which was taken up by the press. The wife of the First Consul, Joséphine Beauharnais, took the part of Mademoiselle Duchesnois, and she was made a *sociétaire* in 1804. In 1832 she retired from the stage. The plays in which she created rôles are *La mort de Henri IV*, by Legouvé; *Hector*, by Luce de Lancival; *Mahomet II*, by Baour-Lormian; and *Ulysse*, by Lebrun.

**DUCESS**, THE. See HUNGERFORD, MARGARET.

**DUCESS OF MAL'FI**, THE. A tragedy by John Webster. The chief source of the play is one of Bandello's *Novelle*. It was produced about 1612, printed in 1623, and is considered the author's finest dramatic achievement.

**DUCHINSKI**, du-kên'ské, HENRYK FRANÇOIS-

# DUCKS



- 1 WHITE FACED WHISTLING DUCK (DRAKE)
- 2 SUMMER, CAROLINA OR WOOD DUCK (DRAKE)
- 3 TOULOUSE GOOSE (GANDER)
- 4 AYLESBURY DUCK (DRAKE)
- 5 ROUEN DUCK (DRAKE)
- 6 INDIAN RUNNER DUCK (DRAKE)
- 7 BLACK EAST INDIAN DUCK (DRAKE)

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ZEK (1817-93). A Polish historian and ethnographer, born in the Ukraine. He studied at the lyceum of Berdichev, in 1848 assisted in founding the Società Italo-Slava, and was for a time interpreter to Achmet Pasha, Prince of Kurdistan. For his services to science he received naturalization papers from Switzerland. His works, devoted chiefly to the exposition of the thesis that Poland and Russia are fundamentally different in origin and character, include *Panslavism* (1854); *The Beginnings of the History of Poland and of Other Slavic Peoples* (1858-63); *Aryan and Turanian Peoples* (1864).

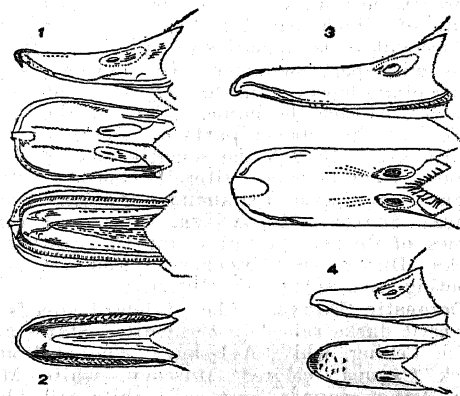
DUCIS, du'sé', JEAN FRANÇOIS (1733-1816). A French dramatic poet, chiefly noteworthy as an adapter to the French stage of Shakespeare's *Hamlet* (1767); *Romeo and Juliet* (1772); *Lear and Macbeth* (1783); and *Othello* (1792). He succeeded Voltaire in the French Academy (1779). His independent dramatic efforts were failures, but his adaptations of English models paved the way for the more daring innovations of Lemercier and the Romantic school. He was unable, however, to rise above the artificial language and conventions of the mediocre classicists of his day, which fact led him to change and weaken the strongest situations in Shakespeare's plays to suit the squeamish taste of his contemporaries. His works were collected in 6 vols. (1827). His *Hamlet*, *Macbeth*, and two other plays are in Didot's *Chefs-d'œuvres tragiques*, vol. ii. Consult Jusserand, *Shakespeare en France* (Paris, 1898), and Lacroix, *Histoire de l'influence de Shakespeare* (Brussels, 1856).

DUCK (AS. *dūce*, connected with OHG. *tūhan*, Ger. *tauchen*, to dive). The ducks are a large and well-defined group of birds of the order Anseres (q.v.) and the family Anatidæ. They are distinguished from the swans and geese by having the tarsi scutellate in front, and the sexes are unlike in color; and they are separated from the mergansers by the shape of the bill, which is broad and flattened. The term "duck" is generally restricted to designate the female, while "drake" is the term applied to the male. The ducks are largely animal feeders (insects, snails, frogs, fish, etc.), although some species are noted for their fondness for wild celery and some other vegetables. The legs are short and placed far back, so that ducks move with difficulty on land, and with the characteristic gait known as a waddle, but they are splendid swimmers, and are noted for their powers of diving and swimming under water. The neck is short as compared with geese or swans. There is a peculiar anatomical feature of the windpipe, consisting of a large dilatation of the trachea on each side at its bifurcation. The tongue is large and fleshy and very sensitive. The plumage is remarkably thick, soft, and compact. The wings are stiff, strong, and pointed, giving the power of rapid and vigorous flight, though the speed of wild ducks has probably been exaggerated. The tail is of variable shape and made up usually of 14 or 16 feathers. The oil gland is always present and well developed, with two openings, and crowned with a tuft of feathers. The ducks have been easily tamed, and many breeds are known which will be considered later by themselves.

**Wild Ducks.** The ducks are easily divisible into two groups, one of which is usually spoken

of as river ducks (*Anatine*), and the other as sea ducks (*Fuliginine*). The latter have an evident lobe or web on the hind toe, which is wanting in the river ducks. These subfamilies are by no means confined to the bodies of water, which might be inferred by the names, for many of the sea ducks are abundant on our large inland lakes and rivers, while some of the river ducks are common "along shore." The sea ducks obtain their food principally by diving for it, sometimes descending, it is said, more than 150 feet; they feed by day and pass the night at some distance from the shore. The river ducks, on the other hand, feed more commonly at night and rarely dive for their food, but obtain it in shallow water by probing on the bottom. The river ducks are seldom seen in flocks of more than 50, while the sea ducks often gather in enormous flocks.

There are something like 65 or 70 species of river duck known, occurring pretty generally throughout the world, about a dozen being found in the United States. The best-known species is the common mallard (*Anas boschas*), which occurs in nearly all parts of the Northern Hemisphere and is the parent form of the breeds of domesticated duck which have originated in Europe, and perhaps those of Asia. In the United States it is far more common in the interior than on the coasts; and it is rare in New England, where it is replaced by the dusky or black duck (*Anas obscura*). The latter is found throughout eastern North America and is the commonest river duck of the New England States. It is about the size of the mallard, but the general color is dusky brown, and the sexes are nearly alike. The lining of the wings is white. The nest is on the ground, of weeds, grass, and feathers; the eggs are 8 to 10 in number, dirty yellowish drab. Like the other river ducks, the black duck is fine game and is highly esteemed for the table. By far the handsomest of America's river ducks is the beautiful wood or summer duck (*Aix sponsa*), described under Wood Duck. Another species of the same genus, the mandarin duck (*Aix galericulata*) of China, is



BILLS OF REPRESENTATIVE DUCKS.

1. Ruddy duck (*Erismatura rubida*), from the side, from above, and from below. 2. Widgeon (*Mareca americana*), from below showing double pectinations. 3. Mallard (*Anas boschas*), from the side and from above. 4. Bufflehead (*Charltonetta albeola*), from the side and from above.

still more remarkably adorned, though it is not perhaps any handsomer. Other well-known river ducks are the gadwalls, widgeons, shoy-



elers, pintails, and teals, all of which are treated of in the proper places. The species most nearly allied to the common duck is said to be the Javanese duck (*Anas javanensis*). The musk duck (*Cairina*) of South America has been domesticated and produces fertile offspring when mated with the common duck. The sheldrakes (*Tadorna*) are numerous in the Australian region and some parts of Asia.

Of the sea ducks, perhaps 50 or 60 species are known, widely distributed in all parts of the world, of which two dozen occur in North America, but comparatively few in the Southern Hemisphere. As a rule, they are not so good eating as the river ducks, as the flesh is coarser and is often rank in flavor. But there are some notable exceptions, such as the well-known canvasback (*Aythya vallisneria*) (q.v.), which is found in suitable localities and at the proper seasons throughout North America. Allied to these are the scaups (q.v.) and the ring-necked duck (*Aythya collaris*), which has a chestnut band around the black neck of the male. The "old squaw" (*Clangula hyemalis*) is a very striking species, which breeds in Arctic regions and winters in the United States as far south as Virginia and also in Europe and Asia. It is easily recognized by the greatly elongated middle pair of tail feathers. A very interesting duck, now believed to be extinct, is the Labrador duck (*Camptolemus labradorius*), which formerly occurred on the North Atlantic coast as far south as Long Island. (See EX-TINCT ANIMALS.) The ruddy duck (*Erismatura rubida*) is a small and attractive duck, about 15 inches long, with the throat and back rufous chestnut and the breast and belly white. The most striking characteristic is the peculiar tail; the coverts are very short, and the stiff and pointed tail feathers are bare to their bases. The ruddy duck is found from northern South America northward to Hudson Bay and is chiefly migratory in the United States. Closely related to it is the curious masked duck (*Nomonyx dominicus*) of tropical America, which is hardly more than a foot long. A very remarkable South American duck is the so-called steamer duck (*Micropterus cinereus*), the adult of which has lost the power of flight on account of the small size of the wings, but it is an expert swimmer. Its movements are so peculiar, however, as to suggest a side-wheel steamer, whence the name. The so-called "tree ducks" of the warmer parts of America are in reality geese, though the scientific name of the genus, *Dendrocygna*, literally means "tree swan." See also BROADBILL; GOLDEN EYE; EIDER; SCOTER; MERGANSER, ETC.; and other names of ducks. See also, for the capture of ducks, DECOY and TRAPPING; and for duck shooting as a sport, see HUNTING.

**Domestic Ducks.** The standard breeds of domestic ducks raised in the United States are: white Peking, white Aylesbury, colored Rouen, black Cayuga, colored Muscovy, white Muscovy, Indian runner, gray call, white call, black East Indian, and the crested white. Of these breeds the first seven are considered profitable to raise; the two breeds of calls and the black East Indian are bantams, and are bred more for the showroom; the crested white may be considered as almost purely ornamental. See Colored Plate of Ducks.

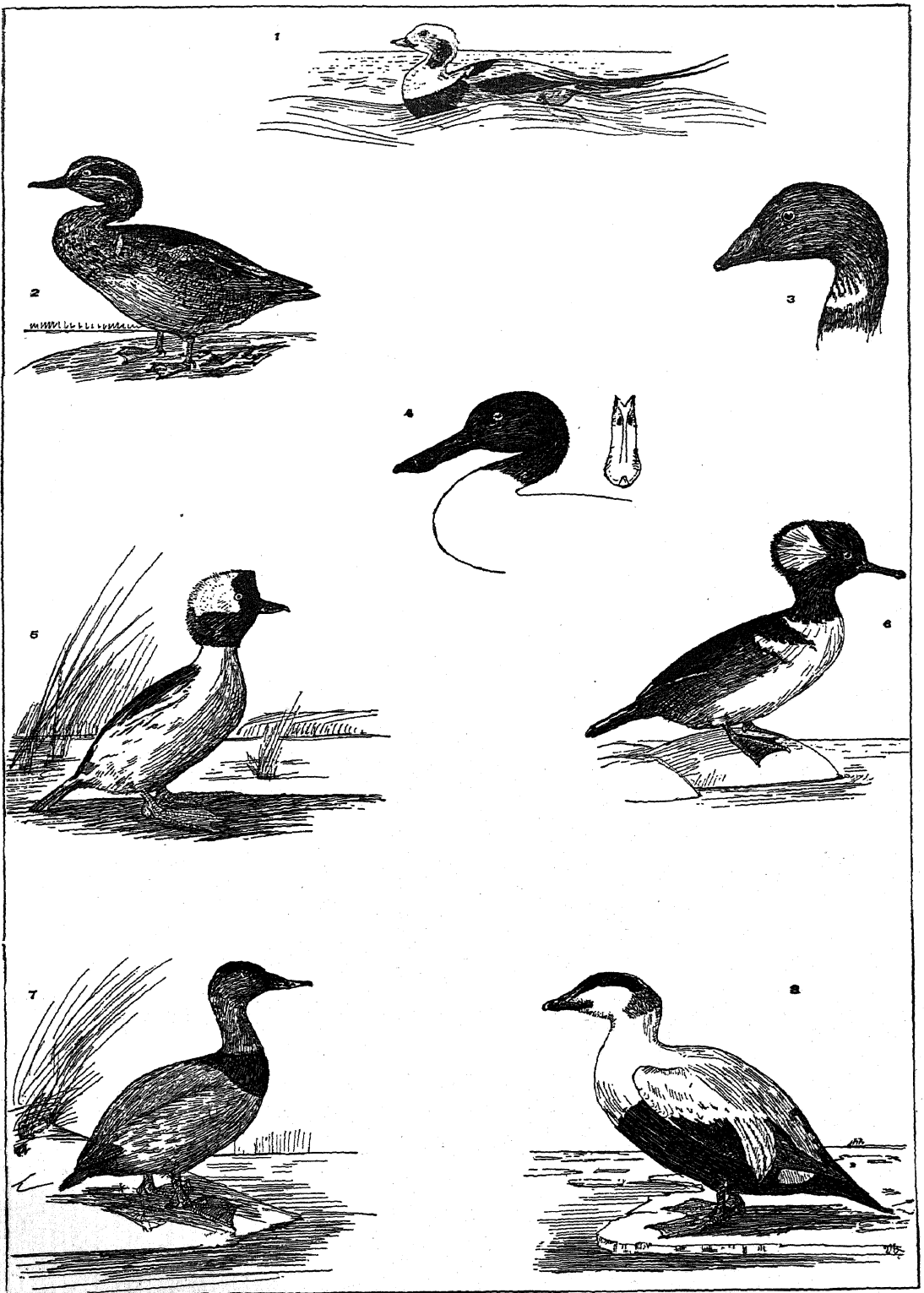
The Peking duck, which leads in popularity, was introduced from China since 1870. It is a

distinct type. Both male and female of standard-breed specimens have a pure yellow bill, white or cream-white plumage, and lead-colored eyes. The neck of a Peking should be gracefully curved; in the drake it should be large and rather long, while that of the duck is of medium length. The back is long and broad; the breast round, full, and very prominent. The body is long and deep, and the standard for adult birds is a body approaching in outline a parallelogram. The wings are short, carried closely and smoothly against the body. The tail is erect, more so than in any other breed. The curled feathers in the tail of the drakes are hard and stiff. These ducks are very large, some reaching as high as 20 pounds to the pair. Their flesh is very delicate and free from grossness, and they are considered among the best of table fowls. They are excellent egg layers, averaging from 100 to 130 eggs each in a season.

The white Aylesbury ducks are also popular for market purposes, especially in England and the continent of Europe. These ducks have white, soft plumage, a long wide bill of a pale flesh or pinkish color; the slender neck is long and gracefully curved, and the body is long and oval. The other breeds differ more or less from the two mentioned above and are characterized by their form, color, size, etc. The colored Rouens and muscovys have ornamental plumage. The muscovy drake has a crest, as have also both male and female of the crested white duck. The Indian breed is the most wide variation from the common type; it assumes an upright position, and the wings are very small; the Indian runner is a breed recently imported to the United States, and has become very popular because of its laying qualities.

**Duck raising** has been developed in the United States into a flourishing industry. Not many years ago the duck was considered an unprofitable fowl to raise; its flesh was never prized very highly by the masses. Ducks were raised without constraint in waterways, feeding mostly on fish and water insects. This food gave the flesh a strong fishy flavor; hence it was not particularly sought after. When properly fattened, the flesh has a very agreeable flavor and is much prized as food. Artificial incubation and brooding, combined with judicious feeding, have been instrumental in the development of the industry. The season for raising ducks is about six months in length, i.e., from February to July. The food of the duck is both animal and vegetable in nature. In the wild state it gathers its food, consisting of flag, grasses, small fishes, water insects, etc., from brooks and marshes. When the birds are raised in confinement, this diet must in a measure be imitated to get the most satisfactory results. Such foods as wheat bran, corn meal, and beef scrap, mixed with water to a mush, with grit and green food, constitute the most satisfactory diet. The food must be in a soft mushy state. Too much hard food, such as grain, does not agree with these birds, and they cannot thrive on it. While some raisers use a small allowance of grain, others do not, and it has not been proved to be of any advantage to feed it. It has been estimated that it costs from 6 to 12 cents a pound to raise a duck for market at 10 weeks of age. The cost of feed is from 4½ to 5 cents a pound,

# NORTH AMERICAN WILD DUCKS



1. OLD-SQUAW (*Harelda hyemalis*).
2. GREEN-WINGED TEAL (*Nettion carolinense*).
3. BRANT GOOSE (*Branta bernicla*).
4. AMERICAN SHOVELLER (*Spatula clypeata*).

5. BUFFLE-HEAD (*Charltonetta albeola*).
6. HOODED MERGANSER (*Lophodytes cucullatus*).
7. CANVAS-BACK (*Marila valisneria*).
8. AMERICAN EIDER (*Somateria dresseri*).



and that of labor, etc., is from 4 to 8 cents a pound. It costs from \$1.75 to \$2.50 each to keep breeding ducks a year. When ducks are raised for breeders, they are fed differently from those intended for market. They are not forced as much as are the latter, and less fattening food is given them. To raise ducks successfully, it is not at all necessary that they should have access to water, except for drinking purposes; they grow and thrive as readily without. There are successful duck farms where thousands of ducks are raised without access to water save that which is given them as drink. It has been a matter of much dispute which is the better way. Some breeds of ducks are very good layers; one of the Buff Orpington, a new English breed, laid 79 eggs in 80 days. Ducks' eggs are larger than hens' eggs, but resemble them closely in composition. (See Colored Plate of Eggs.) They are much used as food, especially in Europe. All species of wild ducks are thought to be monogamous, but domesticated breeds are polygamous. Duck raising is a large industry in China, especially near Hankow, where factories prepare large quantities of albumen and egg yolks for export to Europe.

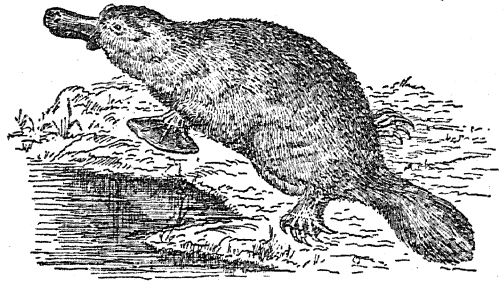
**Bibliography.** Consult: Howard, "Ducks and Geese," in *United States Department of Agriculture, Farmer's Bulletin 64* (Washington, 1897); Yorke, *Our Ducks* (Chicago, 1900), a history of American ducks; Hehn, *Cultivated Plants and Domestic Animals* (trans. by Stallybrass, London, 1891); Nourse, *Turkeys, Ducks, and Geese* (St. Paul, 1909); Rankin, *Natural and Artificial Duck Culture* (South Easton, Mass., 1906); Rogeron, *Les canards* (Paris, 1903); Valentine, *The Indian Runner Duck Book* (Ridgwood, N. J., 1911); Millais, *British Diving Ducks* (2 vols., London, 1913). For wild ducks, consult the authorities referred to under BIRD, especially those books relating to northern latitudes. More special works of popular interest are: Elliot, *Wild Fowl of North America* (New York, 1898); Morris, *British Game-Birds and Wild-Fowl* (London, 1891); Lloyd, *Game-Birds and Wild-Fowl of Sweden and Norway* (ib., 1867); Job, *Among the Water-Fowl*, descriptions and photographic illustrations of breeding habits (New York, 1902); Cooke, "Distribution and Migration of North American Ducks, Geese and Swans," *United States Department of Agriculture, Biological Survey Bulletin 26* (Washington, 1906); Shaw, *Wild Fowl* (London and New York, 1905).

**DUCK** (Dutch *doek*, towel, Icel. *dúlr*, Ger. *Tuch*, cloth, Goth. *gadauka*, table companion). An untwilled fabric of cotton or linen, not so heavy as canvas, but used for similar purposes. (See CANVAS.) The lighter and finer grades are used for women's and children's suits. Duck was woven in the United States in 1724 at New London, Conn., eight looms being in operation on this material; and previously, in 1722, in Rhode Island the General Assembly had voted a subsidy for each bolt of duck from hemp grown in the Province. By 1789 it was an important industry in New England.

**DUCK ANT.** The local name in Jamaica for the white ant or termite. See TERMITES.

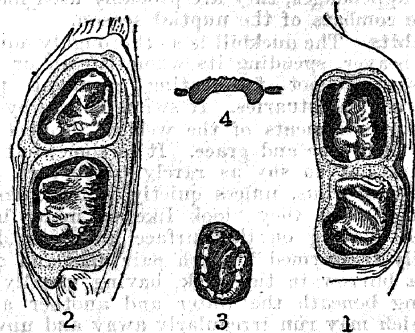
**DUCKBILL**, or PLATYPUS. An aquatic, egg-laying mammal of the order Monotremata, of which only one species (*Ornithorhynchus anatinus*) is known. It inhabits the rivers of Aus-

tralia and Tasmania. The first descriptions of this singular quadruped were received with incredulity, and even when a stuffed specimen was brought to England, it was suspected to have been ingeniously fabricated. The whole length, including bill and tail, is usually from 18 to 20



THE DUCKBILL.

inches. The body is rather long and depressed, the skin loose and thickly covered with glossy hair, among the roots of which there is a layer of soft short waterproof fur like that of a beaver. The head is small and round, with small bright eyes and no external ears, although the internal ears are perfectly developed and the hearing acute; and instead of the muzzle, mouth, and teeth of an ordinary quadruped, the creature is furnished with a bill like that of a duck, but broader in proportion. This incloses the long upper and lower jaws within an extremely sensitive naked skin, almost black in color, possessing a flexible, liplike border all round the mouth. This skin is raised into a frill-like fold round the base of the bill, and, in burrowing and searching for food in the mud, the frill is turned back so as to protect the eyes. The nostrils are situated near the extremity of the upper mandible, so that the animal need only thrust the tip of its nose out of water in order to breathe. The lower mandible has transverse lamellæ, somewhat like the bill of a duck, and each jaw is



DENTITION OF DUCKBILL.

1. Left upper teeth, the ring of indurated epithelium still present. 2. Left lower teeth. 3. A similar fossil tooth of *Microlestes* (q.v.). 4. Diagrammatic section of a fully developed cornule.

furnished with two pairs of horny plates (cornules), the forward ones like sharp ridges, while those behind are broad and flattened. These serve the purpose of teeth for the adults; but true cheek teeth are present in young animals (see *Proceedings of the Royal Society of London*, vols. xliii, 1888; and xlv, 1889), which "are

functional for a considerable part of the life of the animal, cutting the gum in the usual manner, and, after being worn down by friction with food and sand, are shed from the mouth in the same manner as are the milk teeth of other mammals." The corneous ridges grow up around them and take their place. These facts are regarded as evidence that the duckbill descended from ancestors provided with persistent teeth of the ordinary kind. The tongue is small, nonextensible, partly covered with horny spines, and "has a projection towards its hinder part which serves to direct the food collected into two large cheek pouches," where it can be stored and conveniently carried to the burrow or some other comfortable eating place.

The duckbill is aquatic and a burrower, and its skeleton shows adaptation to these habits in the great strength of the bones of the limbs and the pectoral girdle. The legs are short, the forefeet have each five toes, with strong burrowing claws, and a connecting membrane for swimming, which extends even beyond the claws, but is capable of being folded back, so as not to impede their use in burrowing. The hind feet are smaller than the forefeet; they have each five toes armed with claws, and webbed, but the web does not extend beyond the base of the claws. The tail is strong, broad, and flattened, about half as long as the body, covered with longer and coarser hairs, and nearly naked on its under surface. An interesting feature is the strong horny spurs on the heels of the male, which are movable and traversed by a minute canal opening at the point, and connected at the base with the duct from a large gland at the back part of the thigh. The popular belief that these spurs were venomous, to which this animal gave support, has been confirmed by a case by Spicer ("On the effects of wounds on the human subject inflicted by the spurs of the platypus," in *Proceedings of the Royal Society of Tasmania*, Hobart, 1876), of a man who suffered precisely as if locally poisoned, following a wound from the spurs of a captive duckbill. However, as the male alone possesses these appendages, they are probably used mainly in the combats of the nuptial season.

**Habits.** The duckbill is as thoroughly aquatic as a beaver, spending its whole life in or near rivers, but not frequenting stagnant pools nor brackish estuaries. It swims chiefly by flipper-like movements of the webbed forefeet and dives with ease and grace. It is somewhat gregarious, but so shy as rarely to be seen even where numerous, unless quietly watched for at evening, when they "look like so many black bottles floating on the surface and sink down directly if alarmed." Each pair digs and occupies a burrow in the bank, having usually one opening beneath the water and another above it, which may run irregularly away and upward from the stream for 10 or 15 yards before it suits the owners to enlarge it into a chamber bedded with dry grass, where they sleep, rolled up in a ball, most of the day, and where the young are produced. The evil smell of these burrows is notorious in Australia. These animals rarely go ashore, and when they do so waddle about with a curious slipshod gait; yet those in captivity, where they exhibit docility and intelligence, climb about the furniture of a room with surprising agility. "The food consists of aquatic insects, small crustaceans and worms, which are caught under water, the sand and small stones

at the bottom being turned over with the bill. The creatures appear at first to deposit what they have thus collected in their cheek pouches, and when these are filled they rise to the surface and quietly triturate their meal with the horny plates before swallowing it." This food is discovered in the mud not only by an extreme sensitiveness to touch of the margin of the bill, but by smell, of which those studied in captivity show a remarkably high development. The eyes are small and half hidden, but perfect and useful. The duckbill's voice resembles the growl of a young puppy, but the animal's disposition is gentle.

**Oviparous Reproduction.** The duckbill, like other monotremes, actually lays eggs from which the young are hatched—a fact long disputed, and doubtfully believed by the aborigines, who were well acquainted with the haunts and habits of the animal, which they sought both as food and for its skin. The eggs are white,  $\frac{3}{4}$  of an inch long by  $\frac{1}{2}$  an inch broad, the shell is soft and flexible, and they contain a large amount of food yolk, as in birds' eggs. Only a few eggs are laid at a time, often only one, and it is hatched very soon after it is laid. The mother has no nipples, but has milk glands opening into little pits so that the young seem to be suckled by the ejection of the milk into their mouths, which in this early stage are smooth and fleshy. The young are blind and naked at birth.

**Bibliography.** Besides the treatises mentioned above, consult various articles by Owen in the *Transactions of the Philosophical and Zoological Societies of London* (London, 1832–34); Flower and Lydekker, *Mammals, Living and Extinct* (ib., 1891); Beddard, *Mammalia* (ib., 1902); "Catalogue of Papers Relating to the Mammalian Orders, Marsupialia and Monotremata," *Proceedings Linnæan Society, New South Wales*, vol. ix (Sydney, 1894); Bennett, *Transactions of the Zoological Society of London* (London, 1835); Bennett, *Gatherings of a Naturalist in Australia* (ib., 1866). See MONOTREME; and compare ECHIDNA.

**DUCK-BILLED CAT.** See PADDLE FISH.

**DUCK HAWK.** The peregrine. See FALCON.

**DUCKING STOOL.** A rude device, formerly in use in Great Britain and in parts of the United States, for the punishment of women convicted as common scolds (q.v.). It consisted of a rough, strong chair attached to one end of a beam, which worked on a pivot on a post at the edge of a pond or stream of water. The woman was placed in the chair with her arms drawn backward; a bar was placed across her back and in front of her elbows, another bar held her upright, and there were cords to tie her securely in. The officers charged with the execution of the sentence then took hold of a chain at the opposite end and gave her a ducking on the seesaw principle. A ducking stool was in use for the infliction of this punishment at Leominster, England, as late as 1809.

**DUCKWITZ**, duk'vits, ARNOLD (1802–81). A German politician. He was born in Bremen, where, after travels through England and the Netherlands, he became the foremost promoter of shipbuilding and navigation in Germany. He advised the creation of a German customs union, and the harbor improvements of Bremen were also due largely to his initiative. These innovations were followed by the establishment of a steamship line between Bremen and New York and the conclusion of a favorable postal treaty

with the United States. As Imperial Minister of Commerce and Naval Affairs (1848), he promoted the construction of the German navy of the time. In May, 1849, he returned to his native city; in 1857 he was elected burgomaster and served for six years, and was reelected in 1866. In 1873 he retired from public life. He published memoirs entitled *Denkwürdigkeiten aus meinem öffentlichen Leben 1841-66* (Bremen, 1877).

**DUCKWORTH, SIR JOHN THOMAS** (1748-1817). An English naval officer, born at Leatherhead (Surrey). He entered the British navy in 1759, in 1777 accompanied the frigate *Diamond* to North America as a first lieutenant, and later served under Admiral Byron in the West Indies. During the war with France he commanded the *Orion* and the *Queen* of the Channel Fleet, and in 1798 he directed the naval operations attending the capture of Minorca. In 1800 he captured a Spanish convoy from which his share of prize money was nearly £75,000. He was promoted to be rear admiral of the white in 1799 and vice admiral of the blue in 1804, and served in various capacities in the Mediterranean and the West Indies. In 1805 he directed the blockade of Cadiz, and on Feb. 6, 1806, with seven battleships of the line, two frigates, and two sloops, defeated a French squadron of five battleships and three frigates off San . . . . . was sent in 1807 to dictate terms . . . . . His orders proved impossible of execution; his negotiations resulted in nothing, and the Turks, advised by the French, having . . . . . the shore batteries of the Dardanelles, he retreated. From 1810, in which year he became admiral, until 1813, when he was made Baronet, he was Governor and commander in chief of Newfoundland, and he was made Governor of Plymouth a few months before his death.

**DUCLERC, du'klark', CHARLES THÉODORE EUGÈNE** (1812-88). A French statesman, born at Bagères-de-Bigorre. He was for some time a proof reader for *Le Bon Sens* (Paris), of which he became the editor in 1836. From 1840 to 1846 he was on the staff of the *National*, to which he contributed financial articles. The events of 1848 brought him into political life, and he served as Minister of Finance for a short time. From 1871 to 1875 he was a member of the National Assembly and in 1875 was elected its vice president. In the same year he was chosen senator for life, and was elected Vice President of the Senate in 1876. In 1882 he became Minister of Foreign Affairs and President of the Council. Soon afterward he succeeded Fréycinet as Premier, but resigned in 1883, owing to his disapproval of the policy of expelling the princes from the Republic.

**DUCLOS, du'klô', CHARLES PINOT** (1704-72). A French historian, philologist, novelist, and wit. He wrote a *Histoire de Louis XI* (1745), the sound and ingenious *Considérations sur les mœurs de ce siècle* (1751), and the celebrated *Mémoires secrets sur le règne de Louis XIV, la Régence et le règne de Louis XV* (1791), among the best and most curious of the time. He also published very interesting and useful studies in the Celtic and French languages. Duclos aided in revising the *Dictionnaire* of the Academy, of which body he was made perpetual secretary in 1747. His *Œuvres complètes* (10 vols., Paris, 1806) include an incomplete autobiography. Consult Leboucq, *Un homme de lettres au XVIIIe siècle* (Paris, 1902).

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**DUCOMMUN, du'kô'mûn', ELIE** (1833-1906). A Swiss journalist and peace advocate, born at Geneva, Switzerland. Early becoming known for the boldness and liberality of his ideas, he took charge, when but 22 years old, of the *Revue de Genève*. He was also a contributor to *Progrès, Helvétie*, and the *Etats-Unis d'Europe*. For a time he served as chancellor of the Canton of Geneva, and afterward he was general secretary of the Jura-Simplon Railroad Company until it was taken over by the state. Turning his attention to the peace movement, he received from the Congress of Rome (1891) a commission to organize the International Bureau of Peace at Bern. His accomplishment of this task and other activity on behalf of world peace brought him one half of the Nobel peace prize in 1902.

**DUCORNET, du'kôr'nâ', LOUIS CÉSAR JOSEPH** (1806-56). A French historical and portrait painter, chiefly celebrated for the natural deformities which he overcame in order to paint. Having no arms, he used the brush with his feet. He studied at Lille, his native town, which furnished him with a pension to enable him to continue his studies in Paris under Lethère. His pictures are rich in color and dramatic in composition, but, as may be easily comprehended, deficient in draftsmanship. Among his chief works are the "Slave Merchant," in the Museum of Arras; portraits of the father and mother of the artist; the "Parting of Hector from Andromache," in the Museum of Lille; "Edith Finding the Body of Harold" (1855), in the Museum of Amiens; "The Repose in Egypt" and "St. Denis Preaching to the Gauls" in the church of St. Louis-en-l'Île, Paris.

**DUCOS, du'kô', PIERRE ROGER, COUNT** (1754-1816). A French statesman, born at Dax (Landes). In 1792 he was elected deputy from Landes to the National Convention, where he voted for the execution of Louis XVI. After acting as president of the Jacobin Club (1794), he became a member of the Council of Five Hundred, and was chairman of that body, Sept. 4, 1797, when the decree of deportation was issued against the Royalists. He was an ardent follower of Sieyès, through whose influence he became a member of the Directory. After the coup d'état of the Eighteenth Brumaire he became a member of the Consulate with Bonaparte and Sieyès and subsequently was Vice President of the Senate. After the proscription of the regicides under the Second Restoration he fled to Germany. He was killed near Ulm through the upsetting of his carriage.

**DUCOUDRAY, du'kôo'drâ', GUSTAVE** (1832-1906). A French scholar and historian. He was born at Sens (Yonne), studied at the Lycée Henri IV and the Ecole Normale Supérieure, and was connected with the cabinet of M. Duruy when the latter became Minister of Public Instruction. Subsequently he became professor of history and geography at the Ecole Normale de Saint-Cloud. His publications include, besides a series of textbooks for school use: *Cent récits d'histoire de France* (1878); *Cent récits d'histoire de France contemporaine* (1881); *Histoire sommaire de la civilisation depuis l'origine jusqu'à nos jours* (1886), translated into English and revised by J. Verschoyle as *The History of Modern Civilization* (1891); *Récits et biographies d'histoire de France* (1905).

**DUCPÉTIAUX, duk'pâ'té'ô', EDOUARD** (1804-

68). A Belgian publicist, born in Brussels, where he devoted himself to the practice of law. He participated in the revolution of 1830 and was subsequently appointed chief inspector of the prisons and benevolent institutions of the country, an office which he held until 1861. He was long a collaborator on the *Courier des Pays-Bas* and was one of the foremost promoters of prison reform in Belgium. Among his writings are the *Mémoire sur le paupérisme des Flancs* (1844); *La question de la charité et des associations religieuses en Belgique* (1850); *De l'association dans ses rapports avec l'amélioration du sort de la classe ouvrière* (1860).

**DUCROCQ**, du'krôk', THÉOPHILE GABRIEL AUGUSTE (1829- ). A French jurist, born at Lille. He studied at the Lycée Louis-le-Grand and the University of Paris, and was admitted to the bar of Poitiers in 1855. In 1863 he became titular professor of administrative law in the University of Poitiers and in 1884 was called to a similar chair in the University of Paris. His *Cours de droit administratif* (1862), admired for its lucid and lucid in style, is an important work. He also published: *Le conseil d'état et son histoire* (1867); *Etudes de droit public* (1887); *Etudes d'histoire financière et monétaire* (1887).

**DUCROT**, du'krô', AUGUSTE ALEXANDRE (1817-82). A French soldier. He was educated at Saint-Cyr and served in Algeria, in Italy, and in the Franco-German War. At Sedan, when MacMahon was wounded, he took the chief command, surrendering it immediately, however, to General Wimpffen. After the capitulation he was a prisoner of war, but escaped to Paris, where he took command of the Thirteenth and Fourteenth Army Corps and participated in several sorties, among them the last disastrous one of Jan. 19, 1871. After the conclusion of peace he was a member of the National Assembly and in 1872 was appointed by Thiers commander in chief of the Eighth Army Corps, stationed at Bourges. His bitter attitude towards the Republic resulted in his being relieved of his command in 1878. He wrote: *La journée de Sedan* (1871); *La vérité sur l'Algérie* (1871); *Guerre des frontières, Wissembourg* (1873); *Défense de Paris* (1875-78).

**DUCROTAY DE BLAINVILLE**, du'krô'tâ' de blân'vel', HENRI MARIE (1777-1850). A French anatomist and zoölogist. He was born at Arques, near Dieppe, and studied at the University of Paris under Cuvier, whom he succeeded as professor of comparative anatomy in 1832. He was editor of the *Journal de Physique* from 1817 to 1825. He exerted an extraordinary influence over his pupils as a lecturer. In addition to the essays published in the *Annales françaises et étrangères d'anatomie et de physiologie*, in the *Journal of the French Institute*, and in similar scientific publications, he wrote the following works: *Cours de physiologie générale et comparée* (3 vols., 1833); *Ostéographie* (26 serial numbers, with illustrations, 1839-54); *Manuel de malacologie et de conchyliologie* (1825-27); *Histoire des sciences de l'organisme et de leurs progrès comme base de la philosophie* (3 vols., 1845).

**DUCTILITY** (from Lat. *ductilis*, ductile, from *ducere*, to lead). That property of some material bodies by which they are capable of being drawn out in length, while diminishing in breadth, without fracture or separation of their parts. Glass, gums, glues, resins, and some

other bodies, when softened by heat or water, may be drawn into threads. The ductility of glass seems to have no limit; at high temperature this brittle substance may be drawn into threads finer than any hair and of the highest flexibility. Metals are ductile, generally speaking, at any temperature, but their ductility varies greatly with the temperature; some—brass, e.g.—are more ductile at ordinary temperatures than when hot. The ductility of gold is very great: 500 feet of wire may be obtained from one single grain of gold. Next to gold follow, in the order of their ductility, silver, platinum, iron, copper, palladium, aluminum, zinc, tin, and lead. Platinum may be drawn out by making a bar of silver with a platinum core, drawing out the bar to extreme fineness, and dissolving off the silver with nitric acid. In this manner the wires adapted to microscopes for micrometric work are made. Such platinum wire is less than 1/1000 of an inch in diameter. See MATTER, Properties of.

**DUCTLESS GLANDS.** See GLANDS.

**DUDAIM.** See CUCUMBER.

**DUDELL**, düd'del, WILLIAM DU BOIS (1872- ). An English electrical engineer, born in London and educated at the Collège Stanislass of Cannes and at the London Central Technical College. His most important work was in connection with the St. Louis Exposition of 1904, which he received gold medals at St. Louis (1904). He was secretary of the St. Louis International Electrical Congress in 1904 and of the International Conference on Electrical Units and Standards of 1908. In 1912 he was chosen president of the Institution of Electrical Engineers.

**DUDEN**, döo'den, KONRAD ALEXANDER FRIEDRICH (1829-1911). A German philologist. He was born near Wesel and studied philology at Bonn. After organizing the gymnasium at Schleiz in 1869 and continuing that institution, he was appointed in 1876 director of the gymnasium at Hersfeld, an institution which was greatly improved under his management. In 1905 he retired from active life and settled at his country home in Sonnenberg, near Wiesbaden. His important writings on modern German orthography and philology include: *Vollständiges orthographisches Wörterbuch der deutschen Sprache* (1880; 8th ed., 1907); a revision of Friedrich Bauer's *Grundzüge der neuhochdeutschen Grammatik* (5th ed., 1896; 21st ed. of original work; 23 ed., 1901); *Etymologie der neuhochdeutschen Sprache* (Munich, 1893; 3d ed. of the original work by Bauer-Frommann).

**"DUDES AND PHARISEES."** See MUGWUMPS.

**DUDEVANT**, dü'd-vän', MADAME. See SAND, GEORGE.

**DUD'LAY**, MLLÉ., stage name of ADELINE ELIE FRANÇOISE DULAIT (1859- ). An actress of the Comédie Française, well known in tragic rôles. She was born in Brussels and studied at the Conservatoire there. In 1876 she was engaged at the Théâtre Français and made her début in Parodi's *Rome Vaincue*. She made her reputation chiefly in the classic repertoire, notably as Camille, in *Horace*, in *Phèdre*, in *Athalie*, as Monime, in *Mithridate*, and Berthe in *La fille de Roland*. She became a member of the company in 1883.

**DUDLEY.** A town and parliamentary borough in Worcestershire, England, 26 miles north-northeast of Worcester and 8 miles west-north-



west of Birmingham. (Map: England, D 4). It is a well-built town and a chief seat of the iron trade, being in the heart of the so-called Black Country. Its noteworthy public buildings include the parish church, restored in 1862, the town hall, and the general hospital. Dudley sends one member to Parliament. The town's affairs are administered by a mayor, a municipal council of 30, and a board of aldermen of 10 members (see paragraph on *Local Government* under GREAT BRITAIN). It owns and leases its light and power plant, and it maintains public baths, four recreation grounds, two public halls, three libraries, an art school, and a fine cemetery. Dudley is well supplied with educational institutions, which comprise a free grammar school, a technical school, an art school, and art gallery, and a public library, the last four being maintained by the municipality. Its chief industries are iron and brass founding and the manufacture of bricks and glass. To the north-east of the town are the ruins of an old castle, now the property of the Earl of Dudley. It was demolished during the civil wars of the seventeenth century, was rebuilt, but was burned in 1750. Dudley was incorporated in 1865. In the vicinity are iron and coal mines and limestone quarries. The thickest coal seam worked in England, known as the "ten-yard" coal, is in this neighborhood. Pop., 1901, 48,733; 1911, 51,092.

**DUDLEY.** A town in Worcester Co., Mass., 16 miles (direct) south by west of Worcester, on the French River, and on the New York, New Haven, and Hartford Railroad (Map: Massachusetts, D 3). It is in an agricultural district and has a large linen mill. Pop., 1900, 3553; 1910, 4267.

**DUDLEY, BENJAMIN WINSLOW** (1785-1870). An American surgeon, born in Spottsylvania Co., Va. After a prolonged course of professional studies, both in this country and abroad, he settled at Lexington, Ky., in 1814. His specialty was lithotomy, or removing stone from the bladder, and he was known in England as "the lithotomist of the nineteenth century." He was professor of surgery in Transylvania University at Lexington and was the author of many papers on medical subjects.

**DUDLEY, CHARLES BENJAMIN** (1842-1909). An American chemist, born at Oxford, N. Y. He graduated from Yale in 1871 and received the degree of Ph.D. from Sheffield Scientific School (Yale) in 1874. He served as an assistant in physics at the University of Pennsylvania in 1875 and in the same year became chemist to the Pennsylvania Railroad Company, a connection in which he made an important investigation of metals for railroad use. He was a member of various scientific societies at home and abroad and was president of the American Chemical Society (1896-97) and of the American Society for Testing Materials (1902-08).

**DUDLEY, CHARLES EDWARD** (1780-1841). An American politician. He was born in Staffordshire, England, removed to Albany, N. Y., became a prosperous merchant there, and was successively State Senator (1820-25), mayor of Albany (1821-28), and United States Senator (1829-33). His devotion to astronomical science led his widow to give more than \$175,000 for the erection and endowment of the Dudley Observatory at Albany.

**DUDLEY, EDMUND** (c.1462-1510). An English lawyer and statesman. He studied at Ox-

ford, read law at Gray's Inn, and early became a privy councillor to Henry VII. In 1492 he helped to negotiate the Treaty of Etaples with France and in 1497 he became Undersheriff of London, a post then of considerable importance to the crown, as being useful in the collection of revenues from the great feudal chiefs. In this post he amazingly increased the King's wealth and his own. He became Speaker of the House of Commons in 1504. Upon the accession of Henry VIII he was haled before a special commission, by which an indictment was found against him on the ground of an alleged treasonable attempt to depose the throne. After a failure to escape from the Tower he was beheaded on Tower Hill. During his imprisonment he wrote a treatise in defense of absolute monarchy, entitled *The Tree of Commonwealth*, first published in 1859.

**DUDLEY, EMELIUS CLARK** (1850- ). An American gynecologist, born at Westfield, Mass. He graduated from Dartmouth College in 1873 and from Long Island College Hospital in 1875, then entering on the practice of medicine in Chicago. In 1882 he became professor of gynecology at the Chicago Medical College. He was president of the American Gynecological Association in 1904. He published *Diseases of Women* (1898; 1899) and *Principles and Practice of Gynecology* (6th ed., 1913), and from 1902 to 1911 edited the *Gynecological Yearbook*.

**DUDLEY, LADY JANE** (?-1554). See GREY, LADY JANE.

**DUDLEY, SIR HENRY BATE** (1745-1824). An English clergyman and journalist. He was educated, probably, at Queen's College, Oxford, and took orders in the Anglican church. In 1775 he was appointed editor of the *Morning Post* and "contrived, before six weeks were over his head, to be called out for a criticism" (Peabody, *English Journalism*, 1882). He accepted so many challenges for duels that he became known as "the fighting parson." He made the *Post* the most readable and widely circulated newspaper of the time, but he also embarrassed it with expensive actions for libel. Having been at last reluctantly dismissed, he established in 1780 the *Morning Herald*, a Liberal sheet, and at about the same time the *Courrier de l'Europe* (printed in French) and the *English Chronicle*. Through the *Herald* he defended the Prince of Wales—so adequately, in fact, that by 1813 he had been presented to several Irish benefices and the rectory of Willingham (Cambridgeshire) and had been made Baronet. He was a minor contributor to the satirical *Rolliad*, which first appeared in the *Herald*, wrote for the stage, and published *A Few Observations Respecting the Present State of the Poor* (3d ed., 1802), *A Short Address to the Lord Primate of all Ireland* (3d ed., 1808), and other works.

**DUDLEY, JOHN, DUKE OF NORTHUMBERLAND** (c.1502-53). An English statesman. In 1542 he was made an admiral and a peer with the title Viscount Lisle. From that time he displayed notable ability in naval, military, and civil offices. Created Earl of Warwick in 1546 and five years later Duke of Northumberland, he became after the execution of Somerset (1549) second to the King in influence. He schemed to have the succession brought within his own family; and when Edward VI died, Northumberland proclaimed his own daughter-in-law, Lady Jane Grey, Queen. But, finding himself alone, he gave his support to Mary.

Nevertheless he was put to death for treason—at the last moment a penitent Roman Catholic. "Dudley was the ablest man of the time after the death of Henry VIII. He was a consummate soldier, a keen politician, and a skillful administrator. His nature was bold, sensitive, and magnanimous. . . . He was a great man, but his character was spoiled by avarice, dissimulation, and personal ambition." Consult: Tytler, *England under the Reigns of Edward VI and Mary* (London, 1839); Dixon, *History of the Church of England* (ib., 1871-91); Pollard, *England under the Protector Somerset* (ib., 1900); id., *England, 1547-1603* (ib., 1910).

**DUDLEY, JOSEPH** (1647-1720). A Colonial Governor of Massachusetts, the son of Gov. Thomas Dudley. He was born in Roxbury, Mass., and graduated at Harvard in 1665. He early became a member of the Massachusetts General Court and was a magistrate of Roxbury in 1673. In 1682 he was sent to England with John Richards to endeavor to prevent the threatened repeal of the Massachusetts Charter, but, virtually taking the opposite side, he dealt himself with the government, and in May, 1683, three years after his return, was appointed President of "Massachusetts, Maine, New Hampshire, and the mainland of Rhode Island west of Narraganset Bay," having previously acted for several months as censor of the press. On the coming of Governor Andros (q.v.), early in 1687, Dudley became judge of the Superior Court, but, when Andros was overthrown by the popular party, in 1689, he was arrested on a charge of tyranny and usurpation, and was imprisoned for five months, at the end of which time he was sent to England, where, however, he was almost immediately released, the English Privy Council dismissing all charges against him. He then served as Chief Justice of New York from May, 1691, to September, 1692, presiding as such over the court which sentenced Leisler and Milbourne to death; returned to England shortly afterward and served for eight years as Lieutenant Governor of the Isle of Wight. He was made colonel of an English regiment and returned to the House of Commons. In 1702, after much intriguing on his part, he was appointed by Queen Anne Governor of Massachusetts, which position he held in spite of frequent protests on the part of the people, until 1715. As Governor he stood for progressive, and, though an able administrator, frequently antagonized the colonists by his arbitrary conduct, coming into almost annual conflict, in particular, with the Massachusetts General Court over the question of a stated salary for the Governor instead of an annual grant. In the latter part of his administration—during Queen Anne's War—he was active in organizing and fitting out expeditions against the French and Indians. The historian Palfrey gives the following unfavorable estimate of Dudley's character: "Dudley united rich intellectual attributes with a grovelling soul. To his mean nature personal aggrandizement was the prime necessity. He had paid one price for it by dutiful behavior in his early years, and another by useful conduct in middle life, as often as such conduct would not thwart, and especially as often as it would further, the aims of his cupidity." For a somewhat detailed account of his administration as Governor of Massachusetts and New Hampshire, consult Palfrey, *History of New England*, vol. iv (Boston, 1859-75).

**DUDLEY, PAUL** (1675-1751). An American jurist, the son of Gov. Joseph Dudley. He was born at Roxbury, Mass., graduated at Harvard, and studied law in London. He was commissioned Attorney-General of Massachusetts in 1702, was promoted to the bench in 1718, was made Chief Justice in 1745, and for several years was a member of the Legislature. A learned naturalist, he was a fellow of the Royal Society of London and contributed papers on the natural history of New England to its *Transactions*.

**DUDLEY, ROBERT.** See LEICESTER, EARL OF.

**DUDLEY, THOMAS** (1576-1653). The second Colonial Governor of Massachusetts, born in Northampton, Mass. He acted for a time as a page to Lord John Compton, later Earl of Northampton, served as captain in the English army during the French expedition of 1597, became a clerk to Judge Nicolls about 1598, and from 1616 to 1628 was steward of Theophilus Clinton, Earl of Lincoln. In 1630 he emigrated to the Massachusetts Bay Colony, as Deputy Governor under Winthrop, and was, next to Winthrop, probably the most influential man in the Colony. He served 13 years as Deputy Governor, was four times Governor of the Colony—in the years 1634, 1640, 1645, and 1650—was the chief founder of Newtown (now Cambridge), Mass., took an active part in the founding of Harvard College, in 1636, and was twice elected President of the United Colonies of New England. He lived successively at Cambridge, Ipswich, and Roxbury, where he died. He was in many respects a typical Puritan, stern, unyielding, and intensely pious, and has been charged with being particularly narrow, bigoted, and intolerant—many find in his dealings with Anne Hutchinson, Roger Williams, and Samuel Gorton. His latest biographer, however, strongly defends him on all these points. Dudley's daughter Anne, the poet, married Gov. Simon Bradstreet (q.v.). (See BRADSTREET, ANNE.) Consult the painstaking but somewhat partisan biography by Jones, *The Life and Work of Thomas Dudley, the Second Governor of Massachusetts* (Boston, 1899), and Deane (ed.), *The Life of Mr. Thomas Dudley . . . written, as is supposed, by Cotton Mather* (Cambridge, 1870).

**DUDLEY, THOMAS UNDERWOOD** (1837-1904). An American bishop of the Protestant Episcopal church. He was born in Richmond, Va., and in 1858 graduated at the University of Virginia, where for many years he was professor of Latin and Greek. During the Civil War he served in the Confederate army and rose to the rank of major in the commissary department. He studied theology in the Virginia Theological Seminary, was ordained priest in 1868, and in 1870 became rector of Christ's Church, Baltimore, of which he had been assistant rector for a year. He was Assistant Bishop of Kentucky from 1875 to 1884, when he became Bishop. He delivered the Bohnen Lectures (church of Holy Trinity, Philadelphia) in 1881, on *A Nice Discrimination the Church's Need*.

**DUDLEY, WILLIAM LOFLAND** (1859- ). An American chemist, born at Covington, Ky. In 1880 he graduated from the University of Cincinnati. Between 1879 and 1886 he was demonstrator of chemistry and professor of chemistry and toxicology at the Miami Medical College; he then became professor of chemistry, and in 1895 also dean of the medical department, of Vanderbilt University. The first to discover

any physiologic effect from the use of the X-ray, he also demonstrated the most poisonous principle in tobacco smoke to be carbon monoxide, which deoxidizes the blood when inhaled; and he invented a process for working and electroplating with iridium. In 1909 he was United States commissioner to the Seventh Congress of Applied Chemistry at London, and in 1912 he was vice president of the section on law and legislation of the Eighth Congress of Applied Chemistry. He is author of many chemical researches.

**DUDLEY, WILLIAM RUSSEL** (1849-1911). An American botanist, born at Guilford, Conn. He graduated in 1874 at Cornell and studied natural history at the school established by Louis Agassiz at Penikese Island, Mass., in 1874, and at the Harvard Summer School in 1876. From 1876 to 1883 he was assistant professor of botany at Cornell and from 1883 to 1892 an assistant professor directing the study of cryptogamic botany. In 1892 he was appointed professor of botany in the Leland Stanford Junior University. His publications include contributions to scientific journals: *The Cayuga Flora* (1886); *Lackawanna and Wyoming Flora* (1887); *Manual of Histology*, with Prof. M. B. Thomas (1894).

**DUDLEY DIAMOND**, or **STAR OF SOUTH AFRICA**, THE. A heart-shaped jewel weighing 44½ carats, but originally twice that size, purchased by the Earl of Dudley from Hunt and Roskell for £30,000. The latter paid only £12,000 for it. It was found in 1868 by the slave of Nie Kirk, a mine owner in Africa.

**DUDWEILER**, dōd'vī-lēr. A town in Rhenish Prussia, on the Sulzbach, 40 miles east by north of Metz. It has extensive coal mines and manufactures iron machinery, fireproof bricks, and pottery. In the neighborhood is the celebrated Burning Mountain (Brennender Berg), a seam of coal deposits which has been burning for nearly two centuries. Pop., 1900, 16,323; 1910, 21,932.

**DUE BILL**. A written acknowledgment of indebtedness by the signer to the one to whom it is given. An example of its shortest form is this: "I. O. U. eight guineas. John Leslie." Another and more extended form is the following: "Due Currier and Barker seventeen dollars; value received. Frederick Lockwood." While from such an acknowledgment the common law infers an obligation by the signer to pay the specified indebtedness, the paper itself contains no actual or express promise to pay. It is the absence of such a promise that distinguishes it from a promissory note. Unlike a promissory note, also, it is not a negotiable instrument, though, as a claim or demand against the debtor, it is assignable by the payee. See **CHOSE IN ACTION**; **NEGOTIABLE INSTRUMENT**.

**DUELING** (Fr. *duel*, from Lat., *duellum*, a contest between two, *duo*). A duel is a prearranged combat between two persons in which deadly weapons are used. It generally takes place in the presence of witnesses (called seconds), who regulate the mode of fighting, place the weapons in the hands of the combatants, and enforce rules agreed upon. While dueling prevailed in antiquity, there is no doubt that the modern private duel grew out of the judicial duel. (See **BATTLE**, **TRIAL BY**, or **WAGER OF**.) In France it became very common after the famous challenge of Francis I to his rival Charles V in 1528. After this every man of France seemed to think that he was called upon to use

his sword in defending his honor against the slightest imputation. Some kings endeavored to suppress, while others promoted, dueling. Within 18 years, in the reign of Henry IV, it is said, no less than 4000 persons fell in duels. Rigid measures for their suppression were passed, but were rarely enforced. Up to the present time duels are much more common in France than elsewhere, but fatal results are infrequent.

In Germany dueling prevails but little outside the army, navy, and the universities. In the students' contests the vital parts of the contestants are so protected that serious injury seldom occurs. In but few places do the laws permit duels, but in a number of university cities there is no pretense of enforcing the laws. In every German regiment there is a court of honor, to determine all involved points of personal or regimental honor and to decide upon the procedure demanded by the circumstances. Where the result is a duel, and the civil authorities do not take any cognizance of the affair, the military authorities themselves rarely act. It is a point of honor, however, with the individual officer to satisfy the honor of his regiment, regardless of any punishment, that may afterward be meted out to him. The practice of dueling is common throughout all the armies of continental Europe, although in most countries it is prohibited by law.

In Great Britain, under the common law, the act of killing in a duel is held to be murder, however fair the duel may have been; but so long as public opinion approved the duel it was generally found impossible to induce a jury to convict. Legislative enactments against dueling were numerous, during the seventeenth and eighteenth centuries, but had little effect in curbing the evil. In 1844 rigid army rules were established to prevent dueling, and within the last half century but few duels have occurred in England.

How common dueling formerly was, both in Great Britain and America, may be inferred from the number of prominent political leaders who participated in duels. The dukes of York, Norfolk, Richmond, and Wellington, lords Shelburne, Talbot, Lauderdale, Townshend, Paget, Londonderry, Castlereagh, and Fox, Pitt, Sheridan, Canning, Hastings, Grattan, Curran, and O'Connell all fought duels. In the United States Charles Lee and John Laurens, Cadwallader and Conway, General McIntosh and Gwinnett, of the Revolutionary period, and Burr and Hamilton, Jackson and Dickinson, Benton and Lucas, Clay and Randolph, De Witt Clinton and Swartout, and Cilley and Graves, fought duels. In no part of the world was dueling so earnestly engaged in as in America. Combats under all sorts of conditions and with every conceivable variety of weapon, and in the great majority of instances fatal to one or both combatants, were of frequent occurrence, and largely because of this was precipitated the legislation which finally succeeded in stamping out the custom.

Laws now exist in all States of the Union against dueling. In some cases the punishment is death, in others imprisonment, and in others disqualification to hold office. A bill prohibiting dueling in the District of Columbia was passed in 1839.

At the beginning of the twentieth century the custom was almost universally prohibited by law, although countenanced, if not actually de-

manded, by officers, both naval and military, professional men and the upper circles generally, of continental European society. Organized efforts are now being made, however, to attack the custom in its own stronghold and among the classes who still cherish its traditions.

The International League, inaugurated in 1900 by Prince Alfonso of Bourbon and Austria-Este, has been organized with the declared intention of "setting right in the acceptance of society the sense of the words *cowardice* and *courage*, when used in connection with dueling." The French branch of the league is under the direction of M. Joseph du Bourg, and although its influence is as yet very limited, it has had the support of M. Paul de Cassagnac, formerly a well-known duelist, and was considerably aided by the refusal, in 1901, of Lieutenant Colonel the Marquis d'Elbée to accept the challenge of the Marquis de Chauvelin. Early in 1902 the league succeeded in forming a tribunal of honor in Paris, which consists of 14 members, six of whom are military or naval officers, and whose duties are to decide all disputed points without recourse to the duel. In the French provinces similar tribunals have also been organized and have already justified their existence. The anti-duelist movement in Germany is under the active direction of the Prince of Löwenstein and is very strong numerically and influentially. Its membership includes noblemen, soldiers, civilians, and university professors and students. The league publishes a representative periodical and is championed by nearly every prominent newspaper in the Empire. In Italy the Marquis Crispolti has been intrusted with the leadership of the movement, which however, was not begun until late in 1902. On Feb. 14, 1902, the Spanish Republican Fusion party, at Valencia, passed a resolution condemning the duel as contrary to civilization and forbidding members of the party from taking any part in a duel, either as principal or second. In Germany the Socialist party has taken a vigorous stand against dueling, and in 1912, upon the dismissal of a Catholic army officer who refused to maintain his honor by a duel, the Socialists and Catholics succeeded in carrying an antidueling resolution in the Reichstag.

In law, dueling is the criminal offense of engaging or participating in a combat with deadly weapons. The only form of the duel which was ever recognized by the common law was the judicial combat for the trial of appeals of battel, which was introduced into England by the Normans and formed a regular feature of the legal procedure under William the Conqueror and his immediate successors. The private duel, though much practiced during the mediæval period of English history, was never legalized, and was denounced and prohibited by a royal edict of James I in 1613 and by a decree of the Star Chamber in 1614. The hostility of the King's courts to the practice was pronounced, and by 1700 it became an indictable offense. In the United States as well as in England to challenge or provoke a man to fight a duel is dealt with as an incitement to a breach of the peace, and to engage in such a combat is punished as an assault with deadly weapons. If a party to a duel is wounded, the other is indictable for unlawful wounding or for attempt to murder, and the killing of a combatant is punishable as homicide, the seconds and other participants being held equally guilty with the

principal. Consult: Villiger, *History of Dueling* (London, 1841); L. S. . . . Notes on Duels (Boston, 1855); G. Letainturier-Fradin, *Le duel à travers les âges* (Paris, 1892); Paulsen, *German Universities* (New York, 1906); E. Rouziet-Dorcières, *Sur le pré; souvenirs de duels, histoires contemporaines* (Paris, 1910). For a list of works on dueling, consult Levi and Gelli, *Bibliografia del duello* (Firenze, 1903). See ASSAULT; COMBAT; HOMICIDE; MURDER; and the authorities there cited.

**DUE PROCESS OF LAW.** A phrase used in the Federal Constitution and in the constitutions of many of the United States as the legal equivalent of "law of the land," in *Magna Charta* (q.v.). Some of our State constitutions contain both phrases, while others employ the words "due course of law" or "due course of the law of the land." All of these forms of expression are ancient and have long been understood to have the same meaning. They were used interchangeably in a series of statutes enacted under Edward III (5 Edw. III, c. 9; 25 id., c. 4; 28 id., c. 3) and were pronounced by Lord Coke to be legal equivalents. The Fifth Amendment of the United States Constitution declares that "No person shall be deprived of life, liberty, or property without due process of law," and the Fourteenth Amendment contains this clause: "Nor shall any State deprive any person of life, liberty, or property without due process of law." By this phrase is meant the regular and orderly determination of the rights of the citizen, whether by the ordinary courts of the land, the legislature, or by the people in enacting constitutional provisions. As applied to the courts it means law administered according to those rules and principles which have been established by our jurisprudence for the protection and enforcement of private rights; law which hears before it condemns, which proceeds upon due and orderly inquiry, and renders judgment only after trial.

This principle of constitutional law applies as well to the legislative and executive branches of government as to the judiciary. Neither Congress nor a State Legislature can lawfully deprive a person of life, liberty, or property by arbitrary enactment. A statute attempting to do that would not be a law of the land, it would be unconstitutional and void. The same would be true of a like provision in a State constitution. To quote from a decision of the Supreme Court of Missouri: "It is as much out of the power of a State to deprive an owner of his property without due process of law through the medium of a constitutional convention as it would be thus to deprive him by an ordinary act of legislation." But for the check of this principle upon the legislature and the executive, bills of attainder, acts of confiscation, acts reversing judgments, and acts directly transferring one man's property to another might be resorted to, and the time-honored safeguards of constitutional liberty be swept away.

It is not to be understood, however, that the "law of the land" and "due process of law" mean the body of legal rules or the system of judicial procedure which existed at the adoption of the Federal or of a particular State constitution. These may be changed from time to time without violating the constitution, provided the new procedure or the new rules are in accordance with the fundamental principles and maxims of American jurisprudence. Moreover, a State may do

many things in the exercise of its police power which operate to deprive persons of liberty or property in a very summary way, without violating the constitutional provisions under consideration. But these acts are not performed without due process of law, since the State is acting in accordance with those principles governing the limiting the rights of the State and not at variance with them. "In short, 'due process of law' in each particular case means such an exercise of the powers of government as the settled maxims of law permit and sanction, and under such safeguards for the protection of individual rights as those maxims prescribe for the class of cases to which the one in question belongs." See **POLICE POWER**, and consult: Cooley, *Constitutional Limitations* (6th ed., Boston, 1890); Hare, *American Constitutional Law*, Lect. XXXV (Boston, 1889); Freund, *The Police Power* (Chicago, 1904); McGehee, *Due Process of Law under the Federal Constitution* (Chicago, 1906).

**DUER**, dū'ēr, JOHN (1782-1858). An American jurist, born in Albany, N. Y. From about 1820 until his death he practiced law in New York City. He was one of the commissioners to revise the laws of the State in 1823, was elected justice of the Superior Court in 1849, and in 1857 became Chief Justice. His most important work is *The Law and Practice of Marine Insurance* (2 vols., 1845-46).

**DUER**, WILLIAM ALEXANDER (1780-1858). An American jurist, born at Rhinebeck, N. Y. He practiced law at New Orleans, where he was the partner of Edward Livingston, and after 1812 in New York, where from 1814 to 1820 he was assemblyman and from 1822 to 1829 judge of the Supreme Court. In the latter year he was elected President of Columbia College, which position he held until 1842. He published: *Treatise on the Constitutional Jurisprudence of the United States* (1833); *Life of William Alexander, Earl of Stirling*, his grandfather (1847); *Reminiscences of an Old New Yorker* (1867).

**DUERO**, dwā'rō, or **DOURO**, dō'e-rō. A large river of Spain and Portugal, rising in the Spanish Province of Soria (Old Castile), 7389 feet above sea level, about 25 miles northwest of the city of Soria (Map: Portugal, A 2). It flows at first southeast and south, past Soria, receiving the waters of the Rituerto, and then pursues a general westerly course till it reaches the Portuguese frontier. It then flows southwest, forming for about 100 miles the boundary between Spain and Portugal, after which it flows almost due west across Portugal, emptying into the Atlantic 3 miles west of Oporto. Its total length is about 485 miles, over 160 miles of which is in Portugal. The Portuguese portion only is navigable, although its upper course might be utilized to some extent for transportation purposes, despite its swift, narrow current. The river is utilized for carrying the yield of the rich wine-producing territory of the interior to Oporto. Its mouth is closed by a bar and a number of sand banks, which can be passed by ocean-going vessels only, during high tide. The tributaries of the Duero are generally short, the greater number belonging to the Spanish portion. The most important are the Pisuegra, Valderaduey, Esla, Tua, and Tamega, on the right, and the Adaja, Tormes, and Agueda, on the left.

**DUERO**, MARQUÉS DEL. See CONCHA, MANUEL GUTIERREZ DE LA.

**DUET'** (It. *duetto*, from Lat. *duo*, two). A composition for two voices or instruments, with or without an accompaniment of one or more instruments. In technical language, *duet* is applied to a composition for two voices or instruments of the same kind, while *duo* refers to one for two voices or instruments of different kinds.

**DUEZ**, dū'ā', ERNEST ANGE (1843-96). A French genre, portrait, and landscape painter. He was born in Paris and studied there under Pils. After he had obtained several medals at the Salon, his large religious painting, "St. Cuthbert" (1870), was acquired by the Luxembourg. He later painted some fine portraits of those of Madame Duez and Ulysse (at the Luxembourg Museum), but devoted himself chiefly to landscapes and to genre scenes of Parisian life. These are brilliant in color, and fine in line, although in some cases he carried realism to an extreme. He obtained a first-class medal in 1879 and the cross of the Legion of Honor in 1889.

**DUFAU**, dū'fō', PIERRE ARMAND (1795-1877). A French economist and publicist, born at Bordeaux. At the age of 20 he was appointed instructor at the Institute for the Blind, Paris. In 1840 he became director of the institution, and during the following 15 years of his official activity published a great number of works on the treatment and education of the blind. He was also one of the principal founders of the Aid Society for the Blind, established at Paris in 1851. His more important publications include: *Plan de l'organisation de l'institution des jeunes aveugles* (1833); *Statistique comparée des aveugles* (1854); *De la réforme du mont-de-piété* (1855).

**DUFAURE**, dū'fōr', JULES ARMAND STANISLAS (1798-1881). A French statesman, born in Saujon, Charente-Inférieure. He studied law in Paris, was chosen deputy from Saintes in 1834, and acquired great influence in the Liberal party, of which he had been chosen a life member in 1876. In 1863 he was elected to the Academy, taking Pasquier's place. He was appointed Councilor of State in 1836 and Minister of Public Works in 1839. In 1844 he was chosen Vice President of the Chamber and after the revolution of 1848 was Minister of the Interior. Louis Napoleon gave him the same office, but after the coup d'état he returned to the practice of law. In the formation of the Third Republic he took an active part. He was made Minister of Justice in 1871, 1875, and 1877; but when Grévy became President, in 1879, Dufaure resigned permanently from the ministry, though he continued in the Senate. Consult G. Picot, *M. Dufaure, sa vie et ses discours* (Paris, 1883).

**DUFAY**, dū'fā', GUILLAUME (c.1400-74). The greatest master of the first Flemish school of composition. He was born probably at Chimay in Hainaut. From 1428 to 1837 he was a singer in the Papal Chapel, from 1442 to 1449 he lived in Paris, and he died in Cambrai. Many reforms regarding musical notation are attributed to him. At any rate, he cultivated four-part writing with such success that since then it has always been regarded as the foundation of all choral writing. Numerous compositions are preserved in various libraries, and selections from his masses, motets, and chansons, have been published by Haberl and Stainer. Consult F. Haberl, "Wilhelm Du Fay," in *Beisteine für Musikgeschichte* (Leipzig, 1885),

and J. Stainer, *Dufay and his Contemporaries* (London, 1898).

**DUFF, ALEXANDER** (1806-78). A Scottish missionary to India, born at Auchmayle, Perthshire. He was educated at the University of St. Andrews, was ordained to the ministry of the Church of Scotland in 1829, and in the same year was sent as the first missionary of that church to India. He established his headquarters at Calcutta and decided to conduct his work on a new basis, by founding a school which should later expand into a college and in which the English language should be used for instruction, first in the Bible, and secondly in Western knowledge generally, and so to make an appeal to the upper classes. His plan was to carry on evangelistic activity largely by means of educated native preachers. Upon the disruption of the Church of Scotland, in 1843, he adhered, with all other foreign missionaries of the denomination, to the Free church. He was therefore obliged to surrender the mission, with its entire equipment, to the Establishment, to which it legally belonged. Soon, however, he developed a new institution larger and more efficient than the old, with branch schools in surrounding villages. In 1849 he was compelled by ill health again to visit Scotland, where he remained until 1856. In 1851 he was called to the chair of the General Assembly of the Free church and in 1854 traveled and spoke in the United States. He assisted in founding the University of Calcutta and in 1864 permanently returned to Scotland. He was appointed the first professor of comparative theology at New College, Edinburgh, in 1867 and in 1873 was again elevated to the chair of the General Assembly. It was chiefly through his agency that the Livingstonia Free Church Mission, on Lake Nyassa, Africa, was organized. His publications include *The Church of Scotland's India Mission* (1835), and *The World-Wide Crisis* (1873). Consult Smith, *The Life of Alexander Duff, D.D., LL.D.* (London, 1879).

**DUFF, ARCHIBALD** (1845- ). An English Old Testament scholar, born in Fraserburgh, Aberdeen. He was educated at McGill University, Montreal, at Andover Theological Seminary, at Halle, and at Göttingen. Before studying theology he was (1864-69) a high-school teacher in Canada. In 1878 he became professor of Hebrew and Old Testament Theology in the (Congregational) United College at Bradford. In 1874-94 he was an editor of the *Bibliotheca Sacra*. His more important works were: *Old Testament* (1891; 1900); *Hebrew Grammar* (1891); *Theology and Ethics of the Hebrews* (1902); "First and Second Esdras" (1903), in *Temple Apocrypha*; *Abraham and the Patriarchal Age* (1903); *Modern Old Testament Theology* (1908); *History of Old Testament Criticism* (1910); and, translated from the German of Duhm, the *Book of the Twelve Prophets* (1912).

**DUFF, MARY ANN** (1794-1857). A tragic actress, in her time the greatest upon the American stage. Her maiden name was Mary Ann Dyke, and she was born in London. She made her début in Dublin in 1808, and there she became the wife of an Irish actor named John Duff, with whom she came to America in 1810. She first appeared in Boston as Juliet and made her reputation in this and other tragic rôles, including Ophelia, Desdemona, and Lady Macbeth. In 1821, in Boston, she played Hermione

in *The Distrest Mother* so powerfully that Edmund Kean feared it might be forgotten that he was the "star." She first appeared in New York in 1823, as Hermione, to the Orestes of the elder Booth. In 1828 she played at Drury Lane, London, but soon returned to America. In 1835 she played for the last time in New York and was married to Mr. Seaver, of New Orleans. There occurred her farewell to the stage in 1838. Consult Ireland, *Mrs. Duff* (Boston, 1882).

**DUFF, MOUNTSTUART ELPHINSTONE GRANT** (1829-1906). An English diplomat and man of letters, born at . . . . . He studied at Edinburgh and Balliol College, Oxford, was called to the bar in 1854, and from 1857 to 1881 sat in Parliament for the Elgin Burghs, rising to be Undersecretary of State for India (1868-74) and for the Colonies (1880-81). From 1881 to 1886 he was Governor of Madras, and on his return to England acted as president of the Royal Geographical Society (1889-93) and the Royal Historical Society (1892-99). His writings include a number of studies in foreign politics, memoirs of Henry Sumner Maine (1892) and of Renan (1893), *Miscellanies, Political and Literary* (1878), and *Notes from a Diary* (1897-1905), covering the years 1851-1901. Consult the essay on the "Diaries" in Wilfrid Ward's *Ten Personal Studies* (London, 1908).

**DUFFERIN AND AVA, ă'vâ, FREDERICK TEMPLE HAMILTON BLACKWOOD, MARQUIS OF** (1826-1902). A British diplomat and statesman. The only son of the fourth Lord Dufferin, he was born in Florence, Italy. He was educated at Eton and Oxford. He became fifth Baron Dufferin, of Clandeboyne, Ireland, at the death of his father, in 1841, and was lord in waiting to the Queen for several years, under two administrations. He distinguished himself by literary production and in 1855 was attached to the Austrian mission. In 1860 he was sent as British commissioner to Syria to inquire into the massacre of Christians. In 1864 he was appointed Undersecretary of State for India; in 1866, Undersecretary for War; and Gladstone in 1868 made him Chancellor of the Duchy of Lancaster. From 1872 to 1878 he was Governor-General of the Dominion of Canada. He was Ambassador to Russia from 1879 to 1881. While Ambassador to Turkey (1881-84), he went to Egypt to restore order after Arabi Pasha's rebellion. His viceroyalty of India (1884-88) was marked by the annexation of Burma, and an amicable delimitation of the Afghan frontier with Russia, after the Penjdeh affair. He was Ambassador to Italy from 1888 to 1891 and Ambassador to France from 1891 to 1896, when he retired from the diplomatic service. From 1891 to 1895 he was Lord Warden of the Cinque Ports. He received a number of titles, including an earldom in 1871 and the marquise of Dufferin and Ava in 1888. The degree of LL.D. was conferred upon him by several universities and colleges. Oxford University gave him the degree of D.C.L., and Punjab University, a doctorate of Oriental learning. In 1878 he was elected president of the Royal Geographical Society and in 1891 lord rector of Glasgow University. Among his published writings are: *Narrative of a Journey from Oxford to Skibbereen during the Year of the Irish Famine* (1846-47); *Letters from High Latitudes*, descriptive of a yacht voyage to Iceland (1859); *Contributions to an Inquiry into the State of Ireland* (1866); *Irish Emigration and the Tenure of Land in Ireland*



(1867); *Speeches and Addresses* (1882). His wife, Harriet Hamilton, is well known for her philanthropic work among the native women of India and for the interesting books: *The Record of Three Years' Work* (1889); *Our Vice-Regal Life in India* (1890); *My Canadian Journal* (1891). Consult Lyall, *Life of the Marquis of Duffin and Ava* (London, 1905).

**DUFF-GORDON, LADY LUCIE.** See GORDON.

**DUFFIELD, GEORGE** (1794-1868). A Presbyterian clergyman, born at Strasburg, Pa., a grandson of the Rev. George Duffield (1732-90), who was for a time chaplain to Congress. He studied at the University of Pennsylvania in 1811 and was ordained in 1815. He had charges successively in Carlisle, Pa. (1815-34), Philadelphia, New York City, and Detroit (1838-68), and from 1840 to 1848 was regent of the University of Michigan. He was distinguished by a progressive spirit and was prominently identified with the "new-school" movement. In 1832 he was tried for heresy, but was acquitted. In 1862 he was moderator of the New School General Assembly. His publications include: *Regeneration* (1832); *Claims of Episcopal Bishops Examined* (1842); *Travels in the Holy Land; The Divine Organic Law, . . . or Capital Punishment for Murder Authorized by God* (1848).

**DUFFIELD, GEORGE** (1818-88). An American Presbyterian clergyman, son of the preceding, born at Carlisle, Pa. He graduated at Yale in 1837 and at Union Theological Seminary in 1840. He held pastorates in Brooklyn, N. Y. (1840-47), Bloomfield, N. J., Philadelphia, Pa. (1852-61), Adrian, Mich. (1861-65), Saginaw, Mich. (1869-77), and Lansing, Mich. (1877-80). He wrote many hymns, of which "Blessed Saviour, Thee I Love" (1851) and "Stand up, Stand up for Jesus" (1858) are the best known.

**DUFFIELD, JOHN THOMAS** (1823-1901). An American clergyman and mathematician, born at McConnellsburg, Pa. He graduated at Princeton in 1841 and at the Theological Seminary in 1844 and in 1851 was ordained to the ministry of the Presbyterian church. From 1847 to 1850 he was adjunct professor of mathematics at Princeton, in 1850 was appointed professor of mathematics, and from 1862 to 1871 was also professor of mechanics. He wrote *The Princeton Pulpit* (1850) and various monographs, including *The Philosophy of Mathematics* (1866).

**DUFFIELD, SAMUEL WILLOUGHBY** (1843-87). An American Presbyterian clergyman and hymnologist, son of George Duffield (1818-88). He was born in Brooklyn, N. Y., and was educated at Yale, where he graduated in 1863. After 1882 he preached in Bloomfield, N. J. His publications include: *Warp and Woof*, a book of verse (1870); *English Hymns: Their Authors and History* (1886); *Latin Hymn-Writers and their Hymns* (1889), a posthumous publication, completed by Robert Ellis Thompson.

**DUFFIELD, WILLIAM WARD** (1823-1907). An American soldier, born at Carlisle, Pa. He graduated in 1841 at Columbia, served in the Mexican War, and was engineer in the construction of several railways. In 1861 he was appointed lieutenant colonel of the Fourth Michigan Infantry, during the Civil War was twice wounded at Murfreesboro, and rose to be brigadier general and brevet major general. From 1878 to 1879 he was a member of the Michigan Senate, later was active as a railway engineer, in 1892-93 was United States engineer on the White and Wabash rivers, and in 1894-

98 was superintendent of the United States Coast and Geodetic Survey. In the *Survey Report* for 1895-96 he published a valuable table of 10-figure logarithms to 100,000, newly calculated.

**DUFFY, SIR CHARLES GAVAN** (1816-1903). An Irish patriot and author, born in the County of Monaghan, Ireland. In 1842 he founded, in company with Thomas Davis and John Dillon, the *Dublin Nation*, as the organ of the Young Ireland party. In 1846 O'Connell quarreled with the Young Ireland party, which thereupon reorganized under the name of the Irish Confederation. With other members of that body Duffy was tried for treason felony (1848), but was acquitted. He then revived the *Nation*, founded the Irish Tenant League, was elected to the House of Commons (1852), and established the Independent Irish party, but, on account of the opposition of the ultra-Roman Catholics, resigned in 1856 and emigrated to Australia, where he took up the practice of law. He became Minister of Public Works in Victoria (1857), entered the Parliament there, and was Prime Minister in 1871. He was knighted in 1873. Returning to Europe in 1880, he took up his residence at Nice. He published *Ballad Poetry of Ireland* (1845), which has passed through 50 editions; *Young Ireland* (1880), and its sequel, *Four Years of Irish History* (1883), which together cover the period from 1840 to 1850; *Conversations with Carlyle* (1892); *Memoirs* (1898); and other works. Its distillation of the essence of Irish history into a brief, rapid, and interesting narrative makes his *Bird's-Eye View of Irish History* (1882) an extraordinary tour de force.

**DUFOR, du'fōr', CHARLES VALENTIN** (1827-1903). A French archaeologist, born in Paris. He was for some time in the library of the Hôtel de Ville and contributed much to the best French magazines. His scholarly works have placed him among the foremost French archaeologists. They include: *Les charniers des églises de Paris* (1866); *Recherches sur la danse macabre* (1873); *Le vieux Paris, ses derniers vestiges* (1878); *Bibliographie artistique, historique, et littéraire de Paris avant 1789* (1882).

**DUFOR, GUILLAUME HENRI** (1787-1875). A Swiss general, known also as a cartographer and military writer. He was born at Constance, Baden, and studied at the Polytechnic School of Paris, after which he received a commission in the French Engineers. After the fall of Napoleon he entered the Swiss service and was rapidly promoted. In 1847 he commanded the federal forces in the war against the Sonderbund, which he brought to a speedy termination. Among his published works are: *Permanent Fortifications* (1850); *A Manual of Military Tactics* (1842); a treatise on the *Artillery of Ancient and Mediæval Times* (1840). His military map of Switzerland is a masterpiece of its kind.

**DUFOR, JEAN MARIE LÉON** (1780-1865). A French entomologist. He was born at Saint-Sever-sur-l'Adour, where he practiced medicine until his death. His investigations on the anatomy and metamorphoses of spiders, grasshoppers, scorpions, and other insects appeared in a series of more than 200 articles which were published in the *Annales des sciences naturelles*, the *Annales de la Société entomologique de France*, and similar publications, during a period of 50 years (1811-61). One of his most



important discoveries was that of the parasitic Gregarinidae. His works also include *Rélation de voyage dans les montagnes Maudites* (1821), and *Recherches sur les hémiptères* (1833).

**DUFRÉNOY**, du'frā'nwā', PIERRE ARMAND PETIT (1792-1857). A French naturalist. He was born at . . . at the Ecole Polytechnique and the Ecole des Mines, was appointed a professor in the latter, and in 1848 became its director. In 1840 he was elected a member of the Academy of Sciences. His principal achievement as a scientist was the execution, in collaboration with Elie de Beaumont, of a geological map of France (1841), the publication of which, from the fact that it was the first prepared of an entire country, was an important event in the learned world. In connection with this work he spent 13 years of exploration in France, England, and northern Spain. He also devised a new system of classification of minerals, based on crystallography. He was a member of the Academy of Sciences and a commander of the Legion of Honor. His writings include: *Voyage métallurgique en Angleterre* (2d ed., 1837-39), with Elie de Beaumont; *Explication de la carte géologique de la France* (1841-48), also with Elie de Beaumont; a *Traité complet de minéralogie*, with atlas (1844-45).

**DUFRESNY**, du'frā'né', CHARLES RIVIÈRE (1648-1724). A French writer of comedies, born in Paris. He was valet de chambre to Louis XIV and later inspector of the Royal Gardens, in which capacity he introduced many innovations from England. His comedies, *L'Esprit de contradiction* (1700), *Le mariage fait et rompu* (1721), *Le double veuvage* (1701), still enjoy high rank for their brilliant repartee. His *Amusements sérieux et comiques* (1705; 1869) became the prototype of Montesquieu's *Lettres persanes*. His second wife was his washerwoman, whom he married to satisfy the debt he owed her.

**DUGANNE**, dû-gān', AUGUSTINE JOSEPH HICKEY (1823-84). An American author, born in Boston. He early achieved some reputation as a poet by his *Hand Poems* (1844), a collection of verses previously published in newspapers. He was a founder of the American, or "Know-Nothing," party, and served in the Civil War as colonel of the 176th New York Volunteers. Subsequently he was active as an author and journalist and for many years was connected with the *New York Tribune*. A list of his works includes the following: *Comprehensive Summary of General Philosophy* (1845); *The Iron Harp* (1847); *The Lydian Queen* (1848); *Poetical Works* (1856); *Utterances* (1864); *Camps and Prisons* (1865); *The Fighting Quakers* (1866); *Governments of the World* (1882).

**DUGAZON**, ROSE LÈVÈVRE (1755-1821). A French actress, wife of Jean Baptiste Henri Dugazon, whom she divorced soon after their marriage. She was the daughter of a dancing master in Berlin and first appeared on the stage as a dancer at the age of 12, but made her début at the Comédie Italienne in 1774 in a singing part. Two years later she was admitted into the company as "sociétaire" and continued to act in Paris with uninterrupted success for more than 20 years. She was especially successful in her portrayal of such types of character as Jenny in *La dame blanche* and Berthe de Simiane in *Les mousquetaires de*

*la reine*, and later of young mothers and more matronly types such as Marguerite in *Le pré aux clercs* and the Queen in *La part du diable*. These types of character came to be known as "Dugazons" and "mères Dugazons."

**DUGDALE**, SIR WILLIAM (1605-86). An English antiquarian and historian, born in Warwickshire. His researches into the early history of Warwickshire and his adherence to the royal cause led to his being knighted and to his holding a number of offices in the College of Heraldry. His greatest work is the *Antiquities of Warwickshire* (1656; 2d ed., 1730), which has been the model for many county histories. Among his other works are: *Monasticon Anglicanum* (1655-73), written in part by Robert Dodsworth; *The Baronage of England* (1675-76); *Origines Juridicales, or Historical Memoirs of the English Laws* (1666); *Short View of the Late Troubles in England* (1681); *The Ancient Usage in Bearing Arms* (1682). Dugdale bequeathed more than 27 folio manuscript volumes, written in his own hand, to the University of Oxford. They are now in the Bodleian Library, the Heralds' College, and the Ashmolean Museum.

**DUGÈS**, du'zhâ', ANTOINE LOUIS (1797-1838). A French naturalist, born at Mézières (Ardennes). He was professor of pathology at Montpellier until his death. During the last two years of his life he was rector of the university. He was a skillful surgeon and one of the foremost zoölogists of the time. He investigated the anatomy of spiders, moths, frogs, and vertebrata. His publications include: *Recherches sur les maladies les plus importantes des nouveau-nés* (1821); *Manuel d'obstétrique* (1826; 3d ed., 1840); *Recherches sur les batraciens* (1834); *Physiologie comparée* (1838-39).

**DUGGAR**, BENJAMIN MINGE (1872- ). An American plant . . . Gallion, Ala. He studied . . . schools, including Alabama Polytechnic Institute (B.S., 1891), Harvard, and Cornell (Ph.D., 1898), and in Germany, Italy, and France. As a specialist in botany, he held various positions in experiment stations and . . . until 1901, when he was appointed physiologist in the Bureau of Plant Industry, United States Department of Agriculture. He was professor of botany at . . . of Missouri from 1902 to 1907 and thereafter held the chair of plant physiology at Cornell. He was vice president of the Botanical Society of America in 1912 and 1914. His publications include *Fungous Diseases of Plants* (1909), and *Plant Physiology* (1911), besides bulletins of the United States Department of Agriculture.

**DUGMORE**, ARTHUR RADOLYFFE (1870- ). An English naturalist and animal photographer, born in Wales and educated at Elizabeth College, Guernsey, England, and at Turrell's School, Smyrna. He studied printing in Naples and in Rome (1887-88) and in 1889 came to the United States, where he continued his art work and also studied natural history. In 1898 he began to make careful use of the camera as a means of securing lifelike portraits of wild birds and animals. His skill in this work soon made him famous and gave him material for numerous magazine articles and several books of first-rate importance to the literature of natural history, because of the accuracy of his observation and the remarkable fidelity of his photographic illustrations. His most ex-

traordinary achievements with the camera are preserved in his book entitled *Camera Adventures in the African Wilds* (1910), which contains his experience (many of them extremely hazardous) in photographing African big game. Another very valuable as well as interesting volume is *The Romance of the Newfoundland Caribou* (1913), in which he gathered the results of nine seasons of patient and successful camera hunting of that wary animal. His other works include: *Nature and the Camera* (1902); *Nature Portraits* (1903); *Bird Homes* (1904); *Wild Life and the Camera* (1912).

**DUGONG'** (Malay *dūyong*, Javanese *dūyung*). A sirenian or "sea cow" (q.v.) of the family Halicoridae and genus *Halicore*, or, according to some authors, Dugongidae and *Dugong*. It is distinguished by its well-developed dentition and especially by the fact that in the males the incisors of the upper jaw are elongated almost into tusks; also by the fact that the tail is forked or crescent-shaped, and the swimming paws are destitute of any vestiges of nails. In general form it much resembles the manatee (q.v.). The skull is remarkable for the sudden bending downward of the upper jaw almost at a right angle. The upper lip is large, thick, and fleshy, covering the prominent incisors and forming a kind of snout, "something like the trunk of the elephant cut short across." The eyes are very small and are furnished with a third eyelid or nictitating membrane. The skin is smooth and thick, and that of the Australian species yields a valuable oil, used sometimes in medicine, the demand for which has caused the animal to be almost exterminated in that region. The dugong is marine, inclined to gather near the shore in herds, which formerly sometimes numbered hundreds, and browses, with its head beneath the water, on the algæ which grow on submarine rocks in shallow seas. It is usually pursued in boats and speared. The female produces one young one at a birth and shows an affection for it which is proverbial among the Malays. When the young one is taken, the mother is easily secured. Its habit of raising its round head out of the water and of carrying the young under the fore fin seems to have given rise, among the imaginative early voyagers in the Indian Ocean, to the legendary being, half human and half fish, in allusion to which the name Sirenia was bestowed by Illiger on the order. (See MERMAID.) According to Rüppell, it was with the skin of the dugong of the Red Sea that the Jews were directed to veil the tabernacle, and not "badger" skins, as translated in the Authorized Version of the Bible. Three species of dugong are known—one from the vicinity of Australia (*Halicore australis*), one from the Red Sea (*Halicore tabernaculi*), and one from the East Indies (*Halicore dugong*). See MANATEE and EXTINCT ANIMALS; and for fossil forms allied to the dugongs, see HALITHERIUM.

**DUGOUR, JARDY**. See GOUBOFF.

**DUGUAY-TROUIN**, du'gā' trōō'an', RENÉ (1673-1736). One of the most celebrated privateers' and naval officers of France. He was born at Saint-Malo, of a family of rich ship-owners, and, after some schooling at Caen, embarked in a frigate at the age of 13. At 15 he was commander of a privateer and began a marvelous series of exploits, capturing large fleets of transports and attacking and defeating ships of the line. The Channel, the coasts of Ireland

and Holland, the fishing banks of Spitzbergen, and the Spanish Main were the scenes of his activity. As a reward for his services, Louis XIV gave him the command of a frigate in the royal navy. Captured and taken to England, he escaped and continued his destructive activity. In 1707 he attacked an English merchant fleet and its convoy, sank one frigate, and captured three others. In 1709 he destroyed the Brazilian fleet off the port of Lisbon. In 1711 he captured Rio Janeiro after a bombardment of 11 days and extorted a ransom of \$300,000. For his services Louis XIV knighted him and made him successively *chef d'escadre*, lieutenant general, and naval commandant at Brest. Consult: his *Mémoires* (Paris, 1740); Richer, *Vie de Duguay-Trouin* (ib., 1879); the biographies of La Landelle (ib., 1876) and De Bona (ib., 1890).

**DU GUESCLIN**, du gāk'lān', BERTRAND (c.1320-80). A constable of France, the most celebrated French soldier of his age. He was born at the castle of Motte-Broons, near Dinan, Brittany, and entered the service of Charles of Blois by 1342. In 1354 he was knighted and went with the lords of Brittany to England to secure the release of his captive master. He gallantly relieved Rennes, besieged by the Duke of Lancaster, in 1356, and by his help the city held out until the truce of Bordeaux, in June, 1357. He soon took service under the French King and after several brilliant actions was made lieutenant of Normandy and Count of Longueville in 1364. At the battle of Auray, in 1364, he was taken prisoner, but was ransomed, and, becoming commander of the Grand Companies (see CONDOTTIERE), led them into Spain, where he aided Henry of Trastamare in his war against Pedro the Cruel, and was made Constable of Castile. In 1367 he was taken prisoner by the Black Prince, then in alliance with Pedro the Cruel. Being again ransomed, he again fought for Henry, who received the kingdom in 1369, and Du Guesclin for his great services was made Duke of Molinas. In 1370 he was made Constable of France and for 10 years was active and successful in driving the English from the south and west of the country. In 1373 he seized and held most of the strongholds in the Duchy of Brittany. He died while besieging the fortress of Châteauneuf de Randon (q.v.). It is said that before his death the garrison had already promised to capitulate, and that their commander led them out and placed the keys of the castle upon the coffin of the Constable. He was buried in the church of Saint-Denis. Du Guesclin was ugly in appearance, brutal in his manners, and uneducated, but he had great natural abilities and profited by his long experience. Consult: Froissart, *Chronicles*; Luce, *Histoire de Bertrand du Guesclin et de son époque* (Paris, 1876); Stoddard, *Bertrand du Guesclin, Constable of France* (London, 1897).

**DUHAMEL**, du'ā'mēl', JEAN MARIE CONSTANT (1797-1872). A French mathematician, born at Saint-Malo. He occupied chairs in the Ecole Polytechnique, the Faculté des Sciences, and the Ecole Normale Supérieure. Besides numerous memoirs on mathematics, he published the following works: *Problèmes et développements des mathématiques* (Paris, 1823); *Cours d'analyse* (ib., 1841-47); *Eléments de calcul* (1856-57; 4th ed. by Bertrand, 1887); *Cours de mécanique* (1845-46); *Des méthodes dans les sciences de raisonnement* (5 vols., ib., 1866-72;

2d ed., ib., 1878-86). "Duhamel exerted a great influence by the clearness and precision of his teaching. Possessed of a mind more exact than profound, devoting himself especially to perfecting the methods by which science progresses, he had the honor of being the first to give a demonstration of the principles upon which the infinitesimal calculus rests." (Paul Tannery.)

**DUHAMEL, JOSEPH THOMAS** (1841-1909). A Canadian prelate. He was born in Contrecoeur, studied at St. Joseph's College, Ottawa, was ordained in 1863, and became Bishop of Ottawa in 1874 and Archbishop in 1886. Through his efforts the college at Ottawa obtained the powers of a Catholic university.

**DUHAMEL DU MONCEAU**, du'a'mêl' du mô'n'sô', HENRI LOUIS (1700-81). A French botanist. He was born in Paris and devoted himself to botany and arboriculture. He discovered that a disease of the saffron plant is caused by a parasitic fungus attacking the roots. In company with Buffon, and also independently, he experimented in vegetable and animal physiology. He was also interested in nautical matters and during the latter part of his life was engaged as inspector general of marine for the channel district of the French coast. On account of his researches in arboriculture he was elected a member of the Academy of Sciences of Paris. His most important publication is *Traité des arbres et arbustes, qui se cultivent en France en pleine terre* (2 vols., Paris, 1755; 2d ed., known as *Nouveau Duhamel*, ed. Etienne Michel and others, 7 vols., Paris, 1801-19). Other publications on arboriculture appearing between 1757 and 1783 were *Traité des arbres fruitiers* and *Pomona Gallica*.

**DUHM, BERNHARD LAWARD** (1847- ). A German Protestant biblical scholar, born at Bingham, Hanover. He was educated at Göttingen and taught there from 1877 to 1889, when he went to Basel as professor of Old Testament theology. Among his brilliant works are: *Theologie der Propheten* (1875); *Ueber Ziel und Methode der Theologie* (1889); *Kosmologie und Religion* (1892); *Das Geheimnis in der Religion* (1896); *Die Entstehung des Alten Testaments* (1897-1906); *Das Kommende Reich Gottes* (1909; Eng. trans., by Duff, 1911); translations in the metre of the original of Job (1897), the Psalms (1899), Jeremiah (1903), and Habakkuk (1906); and commentaries on these books and on the 12 minor prophets (1911). In Isaiah he attempted to separate certain passages in chaps. xlii, xlix, l, lii, and liii as "servant" songs; and in Jeremiah he set up elaborate metrical tests of style.

**DÜHRING, du'ring, EUGEN KARL** (1833- ). A German philosopher and economist. He was born and educated in Berlin. After practicing law for three years he was compelled to abandon that profession in 1854 because of an affection of the eye which eventually resulted in blindness. He was lecturer on philosophy and political economy at the University of Berlin from 1864 until 1877. His philosophical standpoint is often called materialistic, but the epithet does not do justice to his views. He believed in the competency of reason to comprehend reality. Actual reality as it appears in our experience is for him the only real existence and is thoroughly rational. He strenuously denies the Kantian doctrine that the categories (q.v.) of time and space have

only subjective validity. In ethics he is an opponent of egoism and pessimism. His writings, however, are full of bitter personalities. In 1877 he was deprived of the privilege of lecturing at the University of Berlin because of his violent attacks upon his colleagues in his works. His economic works frequently show the influence of Henry C. Carey. Among his most important publications are: *Natürliche Dialektik* (1865); *Der Wert des Lebens* (5th ed., 1894); *Kritische Geschichte der Philosophie* (4th ed., 1894); *Kritische Geschichte der allgemeinen Principien der Mechanik* (3d ed., 1887), considered one of the best works on that subject; *Kritische Geschichte der Nationalökonomie und des Sozialismus* (3d ed., 1879); *Die Judenfrage als Frage des Rassencharakters* (5th ed., Berlin, 1901); *Sitte und Kultur der Völker* (4th ed., 1892); *Kursus der Philosophie* (1875); *Logik und Wissenschaftstheorie* (1878); *Die Grossen der modernen Litteratur popular und kritisch nach neuen Gesichtspunkten dargestellt* (1893); *Logik und Wissenschaftstheorie* (1905); *Robert Mayer* (1904); *Soziale Rettung durch wirkliches Recht statt Raubpolitik und Knechtsjuristerei* (1907). Consult Döll, *Eugen Dühring: Etwas von dessen Character, Leistungen und reformatorischem Beruf* (1893).

**DÜHRING, döör'ing, LOUIS ADOLPHUS** (1845-1913). An American dermatologist, born in Philadelphia, Pa. He graduated in the medical department of the University of Pennsylvania in 1867 and in 1867-68 was a resident physician of the Philadelphia Hospital. In 1868-70 he studied dermatology in European hospitals and in the latter year established in Philadelphia a dispensary for cutaneous diseases. He was appointed clinical lecturer on dermatology at the University of Pennsylvania in 1871 and professor of diseases of the skin in 1876. His publications include an *Atlas of Skin Diseases* (1876) and a *Practical Treatise on Diseases of the Skin* (1878), the latter having been translated into Italian, Russian, and French.

**DUIFFOPRUGGAR**, dwé'fö-pru'gär, CASPAR (1514-71). One of the first-known violin makers in Europe. He was born at Freising, in Bavaria, but nothing authentic is known of his early career, except that his original name was Tieffenbrucker; the change from that to the one by which he is best known having been caused by his residence in Italy and France, in which latter country he was finally naturalized (1559). He was long reputed to have been the first maker of violins in Europe, but this claim has been seriously challenged by Dr. Coutagne in his *Gaspard Duiffopruggart et les luthiers lyonnais du XVIIe siècle* (Paris, 1893). This authority claims that all the instruments known as Duiffopruggar violins were really the handiwork of Vuillaume, who is supposed to have got his ideas from a *viola de gamba* made by Duiffopruggar.

**DUIKER, or DUYKER**, di'kër or do'kër (Dutch, diver). 1. One of the small African antelopes, or duikerboks, of the genus *Cephalolophus*, often, but confusingly, called bushbucks by English residents and sportsmen; especially *Cephalolophus grimmii*. They abound in forested and bushy districts, moving about in small parties, leaping among the rocks, and dodging into and through the thickets with surprising agility, while their plain colors render them practically invisible when quiet.

All have very convex foreheads and very large eyes and ears, between which, in both sexes, rise two little spike horns and a median tuft of stiff hairs. All these antelopes feed largely on berries and small fruits, and their flesh has an excellent flavor. The typical species known in the north as *deloo* is very common in southwest Africa. It is about 26 inches high, variable in color, and often tamed as a pet. The redbuck of Natal differs mainly in its reddish bay color. The Natal jungles also contain the diminutive bluebuck, or pygmy antelope (*Cephalolophus monticola*), which is the smallest of the score or more of species in this genus, standing only 13 inches high; they "are smaller and lighter in build than a hare and are of a bluish mouse color." The hegoleh, or madoqua (*Cephalolophus abyssinicus*) of Abyssinia or Beni Israel (q.v.); the philantomba (*Cephalolophus maxwelli*) of Sierra Leone; the wood antelope of the west coast (*Cephalolophus sylvicultor*); and the zebra antelope (*Cephalolophus doriae*), also of West Africa, are notable species—the last-named of large size and golden brown in color, striped with black bands across the back and loins. Consult: Schweinfurth, *Heart of Africa* (Leipzig, 1878), and other books of African exploration; also, Randall, *Proceedings Zoölogical Society of London* (London, 1895); Sclater, *Mammals of South Africa* (ib., 1900); Lydekker, *Game Animals of Africa* (ib., 1908). See Colored Plate of ANTELOPES. 2. In South Africa, a diving bird, as a cormorant or the darter (*Plotus levillanti*), the latter illustrated in the Plate of FISHING BIRDS.

**DUILIAN COLUMN.** A column erected in the Forum at Rome in honor of the naval victory of Gaius Duilius (q.v.) over the Carthaginians. The name *columna rostrata* (rostral column), the class to which this belongs, was given to columns commemorating naval victories (from *rostrum*, the beak of a ship), as they had on each side projections in the form of such beaks, which were usually the actual beaks of the captured vessels of the enemy. Michelangelo's restoration of this column is in the Palazzo de' Conservatori, on the Capitoline Hill. Its pedestal retains a portion of the inscription which was on the column erected in Imperial times, to take the place of the original, which had been destroyed by lightning.

**DUILIUS**, dū-īl'ūs, GAIUS. Roman consul in 260 B.C. and victor in the great naval battle against the Carthaginians off the promontory of Mylæ, northwest of Messina, Sicily. In the spring of 260 the Romans launched a fleet of 120 vessels. Duilius' colleague, Gnaeus Cornelius Scipio, was first appointed commander. Having attempted to capture Lipara with the first 17 vessels prepared, he was blockaded by the Carthaginians in the harbor of that island and was captured with his entire squadron. Duilius thus succeeded to the command and with the main Roman fleet met the enemy advancing from Panormus. The inferiority of the Roman vessels and crews was counterbalanced by the successful use of a boarding bridge which Duilius had invented. The Roman vessels ran closely alongside the enemy, dropped the bridge, and thereby grappled the ships together. The conditions thus approximated those of a conflict on land. Of the Carthaginian fleet Duilius sank or captured 50 galleys, includ-

ing the commander's flagship, taken from Pyrrhus. The immediate effect of this victory was, of course, to turn the tide of the war, but its ultimate result was far greater. Rome became forthwith a naval power, able to dispute with Carthage the supremacy of the Mediterranean. Duilius celebrated the first naval triumph in Roman history. He was honored by a memorial column. See COLUMNA ROSTRATA; DUILIAN COLUMN.

**DUISBURG**, dū'is-burk. A town of Rhenish Prussia, situated about 15 miles north of Düsseldorf, between the Ruhr and the Rhine, with both of which it is connected by a canal (Map: Prussia, B 3). In 1905 the neighboring cities of Ruhrort and Meiderich were incorporated with it, and their joint harbors, including the Rhine, Ruhr, and artificial harbors, are said to comprise the largest river harbor in the world. Among its numerous churches that of St. Salvator, a handsome Gothic edifice of the fourteenth century, contains some interesting mural decorations and the tomb of the famous geographer Mercator. It has a beautiful new rathaus, built in 1901, and a museum. The streets are well laid out, and all modern conveniences are controlled by the municipality. The manufactures of Duisburg grew with the improvement of its water front. It is the central mart of the Westphalian coal and iron trade and in turn has huge imports from Spain, Sweden, Russia, the United States, and countries of North and South America. It has iron foundries, blast furnaces, machine works, steel and brass works, important chemical works and factories manufacturing malt liquors, asphalt, glue, varnish, furniture, tobacco, soda, sulphuric acid, soap, starch, and sugar. In addition to the products manufactured in the city, the exports include those of the surrounding country, viz., iron ore, coal, and grain. The total tonnage entering and leaving in 1912 amounted to 20,570,000. Pop., 1900, 92,729; 1905, 192,346; 1910, 229,483. Duisburg is an ancient town. It was the *Castrum Deutonis* of the Romans and the *Dispargum* of the Franks. It was strongly fortified by Charlemagne. In the thirteenth century it became a member of the Hanseatic League, afterward a free town of the Empire, and later a part of the territory of Cleves, but at the close of the Napoleonic wars it was handed over to Prussia.

**DUJARDIN**, dū'zhär'dän', FELIX (1801-60). A French zoölogist, born at Tours, France, April 5, 1801. He studied at Tours and in Paris and was later professor of zoölogy in the Faculté de Rennes. He wrote many works on worms, insects, etc., including *Histoire naturelle des infusoires* (1841), and *Histoire naturelle des helminthes* (1844). He died at Rennes, April 8, 1860.

**DUJARDIN**, KAREL (1622-78). A Dutch landscape, animal, and genre painter, born probably in Amsterdam. He was a pupil of Nikolaas Berchem and was influenced by Potter, but went to Italy while still young and did not return to Holland for several years. His pictures have more of the Italian than the Dutch atmosphere. They usually represent landscape, with figures and animals painted with freshness and animation and broad and able technique. This is especially true of his genre scenes with horsemen; but he also painted portraits and religious subjects, the

latter with little success. Dujardin's pictures were frequently imitated. The best of them are in the Louvre in Paris, and one of these, "The Charlatans" (1657), is his masterpiece. He is also well represented in the Rijks Museum, Amsterdam, where there is a fine portrait of himself; in Brussels, Berlin, and the National Gallery, London. He left some etchings of animals and landscapes.

**DUKAS, PAUL** (1865- ). A French composer, born in Paris, Oct. 1, 1865. He studied at the Conservatory under Dubois, Mathias, and Guiraud, and with his cantata *Velléda* won the second Prix de Rome. He attracted general attention with his orchestral work *L'Apprenti Sorcier* (1897), since which he has been regarded as one of the leaders of the modern French school, and one whose influence is second perhaps only to that of Debussy. He also wrote a symphony and three overtures, *King Lear*, *Götz von Berlichingen*, *Polyeucte*, and his compositions for piano possess unusual merit. His opera *Ariane et Barbe bleue*, on a text by Maeterlinck, scored a great success in Paris in 1907. It soon found its way into Germany and Austria and was also heard in the United States (Metropolitan Opera House, 1911).

**DUKATO, CAPE.** See CAPE DUKATO.

**DUK-DUK**, duk'duk'. A secret, but not essentially mystic, social organization of the littoral Melanesians on St. George's Channel in the Bismarck Archipelago and most highly developed on the northeast coast of Gazelle Peninsula, New Pomerania. Though the Duk-duk plays a very large part in the life of the community, and similar societies are common in the Solomon Islands to the south and elsewhere in New Pomerania, this organization appears to be no older than a century or at most five generations. The central spot of Duk-duk ceremonies and initiations is a clearing (*taraitu*) in the forest, hidden from chance passers by a curtain of undergrowth; temporary areas (*manamauung*) used in public processions for shifting the burdensome masks of the participants are formed by raising a screen of mats. The germ sense of all rites of initiation is that the ever-living mother principle, the Tubuan, gives birth to her son, the Duk-duk, personifying the postulant for membership, a theme common to primitive religions as the new birth. The Tubuan is a female spirit, a purtenance of some man of wealth or rank, and each has her distinctive name; the right to the Tubuan is hereditary or may be purchased by large amounts of shell money. The garb in ceremonies distinguishes between symbolic mother and son: they are clad alike in a bushy cloak of leaves covering the trunk; the Tubuan wears a mask covering the whole head and extending in a short cone crowned with a thick bunch of cockatoo feathers; the Duk-duk, a mask with longer and sharper cone decorated with pieces of carved wood, wreaths of feathers, and other bright adornment. Although the organization bears evidence of matriarchy in its drama, membership is forbidden to women, who may not even approach the *taraitu*, with the exception of a few old crones who render certain minor services. Induction into the society entails beatings by the older members which frequently inflict lasting harm, the payment of shell money, and lavish feasts. The beatings at times of public feasts extend to all uninitiate

onlookers, but in that case the strokes are rather ceremonial than lasting, since the clubs are dried banana stalks which inflict more sound than fury. The payment for initiation sometimes amounts to 100 fathoms of shell money, the price of at least 10 young and good wives. This charge is so heavy that the junior members of the society are obliged to work at productive labor for no small term of years in order to satisfy the debt. The advantages accruing from membership are that the member has support in time of need, enjoys the pleasure of the social club, and may deal high-handedly with uninitiates. The songs of the society are frequently unintelligible, but that is not a character in particular, for many savage chants have endured beyond their meaning. The language of the society is common speech somewhat disguised by strange terminations after the manner familiar in hog Latin. Consult: the first account of the Duk-duk in Wilfred Powell, *Three Years among the Cannibals of New Britain* (London, 1884); Graf von Peil, in *Journal of the Royal Anthropological Institute* (ib., 1897); Schurtz, *Altersklassen und Männerbünde* (Berlin, 1902); Parkinson, *Dreissig Jahre in der Südsee* (Stuttgart, 1907); George Brown, *Autobiography* (London, 1908); id., *Melanesians and Polynesians* (ib., 1910).

**DUKE** (Fr. *duc*, It. *duca*, Sp., Portug. *duque*, MGk. *δούξ*, *doux*, from Lat. *dux*, from *ducere*, to lead). A title given among the Romans to a general commanding a single military expedition and holding no other power than that which he exercised over his soldiers. The designation first arose in the early part of the second century and entered into the official hierarchy of Rome very soon after. Upon the separation of the civil and military functions in the fourth century the duke became commander of all the troops cantoned in a single province. In an Imperial almanac edited about the year 400, 25 dukes are mentioned in the whole extent of the Empire, 13 in the east and 12 in the west. The prerogatives of the dukes at this time were extensive. At first they were judges in all military trials within their jurisdiction, but, in Italy at least, they ended by centralizing in their own hands all the civil and military powers. The Byzantine duke was chief of the provincial soldiers, named the civil and military officers of the lower grade, and heard appeals from their decisions. He held the civil and criminal jurisdiction and even sat with the bishop to hear ecclesiastical cases. He protected the church and had important functions in its administration. Finally, he took a part in managing the financial affairs of the province. See EXARCH.

In France, under the Merovingian rule, the dukes became the highest officers in the provincial administration. At first they had been only military chiefs, but about the seventh century they gained the same military and judicial powers as the counts. (See COUNT.) The latter, however, governed but a single *comitatus*, or county, while the duke's administration extended over several *comitatus*, each with its count. When the King appointed a duke, it was frequently for the purpose of preventing or repressing a revolt of the counts or for the defense of the frontier. There was a ducal tribunal, but it was not always superior to that of the count. Apparently the tribunal was held in special cases by the order of the King.

The possibility of conflicting powers caused frequent strife between the dukes and counts. The counts did not differ greatly from the dukes, but as the central power grew weaker in this period, the power of the dukes increased. The dukes acquired regal rights and by the end of the tenth century had made their tenure hereditary in France. They had acquired independence and were no longer held to the central power except by the weak bond of vassalage. In general, the duke assumed all the rights which the King could not retain for himself. Towards the close of the twelfth century royalty strove to regain the rights of which it had been robbed. The dukes, however, retained their powers longer than the lesser dignitaries. Some duchies were reunited to the crown, but new ones were created, so that the number increased as their size decreased. Gradually, however, the powerful ducal sovereignties were extinguished, and by the early part of the sixteenth century the King had no rival to fear. The duchies granted after the thirteenth century, as a general thing, enjoyed none of the ancient privileges of independent sovereignty. The dukes were only the first subjects of the realm. Titles of nobility in France were abolished by the Constituent Assembly during the Revolution, but were restored by Napoleon, and the ducal title was conferred on his marshals. Several ducal peers were created by Louis XVIII and Charles X. In Germany the dukedom passed through phases somewhat similar to those which it had exhibited in the earlier history of France. What is peculiar to the position of the nobility of Germany will be found under GRAF.

Dukes, in the older European sense, do not appear ever to have existed in England. The title seems not to have been known earlier than the reign of Edward III, although "earl" was sometimes translated into Latin as *dux*, even before the Norman Conquest; and from the first it was a mere honorary distinction. The Black Prince, who was created Duke of Cornwall in 1337, was the first English duke. In 1351 Henry, the King's cousin, was created Duke of Lancaster, and when upon his death his daughter was married to John of Gaunt, the King's fourth son, the title was transferred to him, his elder brother Edward made Duke of Clarence. In the latter's reign—that of Richard II—the two younger sons of Edward III were created, the one Duke of York, and the other Duke of Gloucester. The dignity was thus, in the first instance, confined to the royal house. But the families of Holland and Mowbray very soon received the same title, and one of the Beauforts, an illegitimate son of John of Gaunt, was raised to the peerage with the title of Duke of Exeter. In the reign of Henry VI the title was granted more widely, and there were at one time 10 duchesses in his court. The Staffords, Beauchamps, and De la Poles belonged to this period. King Henry VIII created only two dukes—one, his illegitimate son, whom he made Duke of Richmond; and the other, Charles Brandon, who married his sister Mary and was made Duke of Suffolk. Queen Elizabeth found only one duke when she came to the throne—Thomas Howard, Duke of Norfolk—attainder or failure of male issue having extinguished the rest of them. After the attainder and execution of the Duke of Norfolk, there was no duke in England, except the

King's sons, till Ludovic Stuart, a relative of the King, was made Duke of Richmond in 1623. In 1623, also, Villiers was made Duke of Buckingham. On the Restoration Charles II raised the Scymours to the rank of dukes of Somerset, and created Monk Duke of Albemarle. But the custom of conferring this dignity on the illegitimate sons of the monarch was still adhered to, as in the case of the Duke of Monmouth, who was the illegitimate son of Charles II, and the Duke of Berwick, son of James II. Of the existing dukes, besides the descendants of Charles II, there are only three families whose titles date from before the revolution of 1688, the Dukes of Norfolk, Somerset, and Beaufort. William and Anne, by advancing a very considerable number of the first families of peers to the rank of duke, altogether changed the character of that dignity. In 1913 there were 26 dukes in the House of Lords in addition to the dukes of the royal blood. The ducal coronet, as now worn, has eight golden leaves of a conventional type, set erect upon a circlet of gold. The stalks of the leaves are so connected as to form them into a wreath. Consult Cheruel, *Dictionnaire historique des institutions, mœurs et coutumes de la France*, vol. i (4th ed., Paris, 1874), and Debrett, *Peerage, etc.* (London, 1912).

**DUKE, JAMES B. (1857– )**. A leading American tobacco manufacturer. He was born near Durham, N. C., and became a member of Duke Brothers & Co., manufacturers of smoking tobacco, and, after this firm was absorbed by the American Tobacco Company in 1890, president of the latter. He was chosen president also of the Continental Tobacco Company (incorporated 1898) and of the Consolidated Tobacco Company (incorporated 1901), and chairman of the board of directors of the British-American Tobacco Company, Ltd. In addition he held directorates in many other corporations.

**DUKE, JOHN.** See COLERIDGE, JOHN DUKE, BARON.

**DUKE HUMPHREY'S WALK.** The middle aisle of old St. Paul's, London, where the tomb of Duke Humphrey (see HUMPHREY, THE GOOD DUKE) is said to be. The old saying of "dining with Duke Humphrey" was in allusion to persons who walked there during dinner time.

**DUKE OF EXETER'S DAUGHTER.** A nickname applied in the fifteenth century to an English instrument of torture resembling a rack. It was erected by the Duke of Exeter (hence its derisive name), the Duke of Suffolk, and other ministers of Henry VI who wished to introduce into England the Roman civil law. But it was never used—indeed its use, judges decided, would be unconstitutional—so it was put away in the Tower of London, where it now is.

**DUKE OF GUISE, THE.** A tragedy, of political significance, by Dryden and Lee, published in 1682 and directed against the violent Whiggism of Shaftesbury and Monmouth.

**DUKE OF YORK'S SCHOOL, or ROYAL MILITARY ASYLUM.** A school founded at Chelsea, by Frederick, Duke of York, in 1801–03, for the support and education of soldiers' orphans. Originally girls as well as boys were admitted, but the admission of girls was discontinued after some years' trial. The institution is supported by parliamentary grant and is under the control of a board of commissioners. Boys leaving school in many cases



enter the army or are apprenticed to trades. There are some 500 boys in the school.

**DUKHOBORTSY**, du'kô-bôrt'si, or DUKHOBOES (Russ., spirit wrestlers, from *dukhû*, spirit + *boroti*, to overcome, to fight; so called from the denial by the sect of the divinity of the Holy Ghost). A Russian religious sect dating from 1733 and formally founded in Kharkov about 1740-50. It increased in numbers under Kolesnikov in the government of Ekaterinoslav (1750-75) and under Kapustin in Tambov (1755-85). This rapid growth caused governmental persecutions in 1793-94 and 1797-1800, but Commissioner Lopukhin's favorable report of 1801 moved the government, on his recommendation, to settle the Dukhobortsy on the bank of the river Molochnaya in Taurida. A large tract of fertile land and a comparative immunity from official annoyances brought a period of thrift and prosperity to this religious community. About 1819 the government resumed hostile measures, which culminated in their deportation to Transcaucasia in 1837. Pobiedonostsev's policy of bringing all religious elements of the Empire into conformity with Greek Catholicism was responsible for the severities which attracted the world's attention to this sect in the nineties. After long petitioning, many thousands were allowed to leave for Cyprus and Canada.

In the fall of 1902 the sect in Canada suffered great hardships. They felt inspired to seek the Christ and set out across the bleak stretches of Manitoba, regardless of all personal discomfort. The cold was intense, and many fell by the way. At length, urged by a spirit of humanity, the government insisted on their returning to their homes. The growth of this society is gradual, if slow. Canada now harbors over 9000 Dukhobors.

Their religious views are simple and handed down by oral tradition, which they significantly call the "Book of Life." Christ was only a man of superior godlike intellect, and his soul has migrated into many mortals, Kolesnikov and Kapustin among others. All people are equal and, being children of God, cannot do wrong; hence there is no need of rulers. Worshiping God in the spirit, the church, with all its agents and formalities, seems entirely superfluous to them. They therefore do not visit churches, considering that wherever two or three persons, united by a common religious tie, gather for worship, there is a church. Praying inwardly at all times, they come together for prayer meeting on certain fixed days, when every one is regarded as a bearer of the divine Spirit. In this and other respects they very much resemble the Society of Friends. They accept the Ten Commandments literally and of the Bible "only the useful" portions, interpreting the rest allegorically. They have no icons, confession, or ceremonies at marriages, which they contract on their conscience only. In private life wives and husbands are sisters and brothers, while parents are addressed as "old man" or "old woman." The plenary power of a Dukhobor community is vested in the assembly of elders. Consistent nonresistants, they are opposed to wars of any kind, nor do they sanction the killing of any of God's creatures for food or sport. As members of society, they are generally conceded to be quiet, sober, and hard-working. They belong exclusively to the peasant class.

Consult: Novitsky, *The Dukhobortsy: Their History and Religious Beliefs* (2d ed., Kiev, 1882, in Russian); Tchertkoff, *Christian Martyrdom in Russia* (Toronto, 1899); Elkinton, *The Doukhobors* (Philadelphia, 1903); Maude, *A Peculiar People, the Doukhobors* (New York, 1904).

**DU'KINFELD**. A municipal borough of Cheshire, England, on the Tame, 5 miles east of Manchester. It has large cotton factories, iron foundries, fire-brick and tile works, and collieries. The town was incorporated in 1899. It owns its gas works and, with the neighboring town of Ashton-under-Lyne, owns its water supply and maintains a cemetery. It has established a fire department and acquired a technical school and free library. Pop., 1901, 18,929; 1911, 19,426.

**DULAG**, dōō-lāg'. A town of Leyte, Philippines, near the foot of Manacagan Mountain, situated on the east coast of the island, 22 miles from Tacloban. There are large sulphur deposits in the vicinity. Pop., 1903, 14,884.

**DULANGAN**, dōō-lān'gān, or GULANGANE. A wild Malayan people, pure and mixed, in Dávao Province, Mindanao. See PHILIPPINES.

**DULANY, DANIEL** (1686-1753). A colonial lawyer of Maryland. He was born in Ireland, emigrated to Maryland about 1700, was admitted to the Maryland bar in 1710, became a member of the Council of State, and was for some years commissary general of the Province. He wrote a vigorous pamphlet entitled *The Right of the Inhabitants of Maryland to the Benefit of English Laws*.

**DULANY, DANIEL** (1721-97). The foremost lawyer in Maryland during the Colonial period, son of the preceding. He was born in Annapolis; was educated at Eton College, Cambridge University, and the Temple, England; was admitted to the bar of Maryland in 1747 and soon gained the reputation, both in England and in America, of being one of the greatest lawyers of his time. He was deputy commissary and commissary general from 1754 to 1761, was a member of the Provincial Council from 1757 to 1775, and was Deputy Secretary and Secretary of Maryland from 1761 to 1773. In 1765 he wrote a powerful pamphlet against the Stamp Act, entitled *Considerations on the Propriety of Imposing Taxes on the British Colonies, for the Purpose of Raising a Revenue, by Act of Parliament*. Though published anonymously, it was immediately recognized as his and was later published under his name. The best argument against arbitrary taxation hitherto written, it attracted widespread attention, had a tremendous influence both in America and in England, and formed the basis of Pitt's great speech in 1766 against the Stamp Act. Dulany consistently opposed the radical measures of the Patriot party, refused to take any part in the Revolution, and in consequence lost, by confiscation, nearly the whole of his vast estates. Consult an article by J. H. B. Latrobe, in the *Pennsylvania Magazine of History and Biography*, vol. iii (Philadelphia, 1879), and Tyler, *Literary History of the American Revolution* (New York, 1897).

**DULAURE**, du'lôr', JACQUES ANTOINE (1755-1835). A French publicist and historian, born at Clermont-Ferrand. He studied in Paris and afterward became engaged in several engineering projects, one of which involved the construction of a canal between Bordeaux and Bayonne. He



was editor of the *Evangelistes du Jour* and developed an extraordinary journalistic activity during the Revolution. In 1792 he was elected a member of the National Convention and became identified with the Girondists until the downfall of that party. As one of the Council of Five Hundred, he devoted himself chiefly to the improvement of the educational system and afterward became one of the bitterest opponents of Napoleon, until the appointment of the latter to the Consulate, when he retired from politics. He was not only a distinguished legislator, but an inventor of considerable ability, as attested by the ingenious instrument known as the pantograph, which he devised. His publications include: *Histoire abrégée de tous les cultes* (1825); *Description des principaux lieux de France* (6 vols., 1788-90); *Histoire civile, physique, et morale de Paris* (7 vols., 1821, frequently reprinted; continued by Leynadier, 5 vols., 1862, and by Rouquette, 1875 et seq.); *Esquisses historiques des principaux événements de la révolution française* (6 vols., 1823-25; frequently reprinted), a history of the French Revolution to the restoration of the Bourbon dynasty; *Histoire de la révolution française depuis 1814-30*, in collaboration with Vigner and others (8 vols., 1834-41; frequently reprinted).

**DUL'CAMA'RA.** See BITTERSWEET.

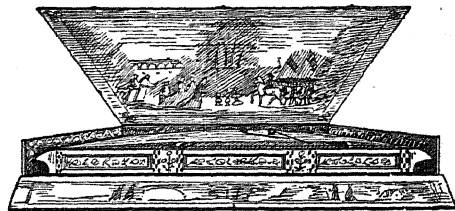
**DUL'CE DO'MUM.** A school song of Winchester School, England, said to have been composed by a boy detained at the school during the Whitsuntide holidays. It dates from the eighteenth century. It is sung by the students in procession on the evening before the holidays.

**DULCE Y GARAY,** dool'thā ē gā-rī', DOMINGO, MARQUIS OF CASTELL-FLORIT (1808-69). A Spanish soldier and governor-general, born at Sotés, Province of Logroño. He participated in the first Carlist War, during which he rendered heroic service, and while Captain General of Catalonia he helped to promote the revolution of 1854. In 1862-66 he was Captain General of Cuba, in which post he furthered all reforms, particularly such as led to the suppression of the slave traffic. He was reappointed in 1869, but soon after resigned.

**DULCIGNO,** dool-chē'nyō. A fortified seaport of Montenegro, on the shore of the Adriatic, 15 miles south-southwest of Scutari (Map: Balkan Peninsula, B 4). It has a mediæval castle which was once an important stronghold. The harbor is difficult of access, but deep enough for heavy vessels. The inhabitants, numbering about 5000 in 1912, are engaged chiefly in oil trade and seafaring. Dulcigno belonged until 1180 A.D. to the Byzantine Empire and subsequently to the Serbs and Venetians, passing to Turkey in 1571. It was taken by the Montenegrins in 1878, but did not come permanently into their possession until 1881.

**DUL'CIMER** (OF. *doulcemer*, from Sp. *dulcemele*, It. *dolemele*, dulcimer, from Lat. *dolce melos*, sweet song, from *dulcis*, sweet, and Gk. μέλος, *melos*, song). A very ancient musical instrument which has varied greatly in its form. In modern times its construction has resembled a flat box, with sounding board and bridges, strung with thin wire, and played on by striking the wires with mallets which have one soft and one hard face. Its compass is from g to g<sup>2</sup>. In England its tuning has been always diatonic, but in Germany towards 1800 it became chromatic. The dulcimer was the prototype of the

pianoforte just as the psalterly was of the harpsichord, the sole difference between them being that the dulcimer was played with hammers and the psalterly with a plectrum. It was formerly



DULCIMER IN CASE.

supposed that the dulcimer was of German origin, but it is more likely that it came from the East through the Crusades; for it was known in Persia and Arabia for centuries under the name of santir. By 1550 it was known in Europe under its present name, but little importance was attached to it. The pantaleon (q.v.) was an enlarged form of a dulcimer. See PIANOFORTE.

**DULCINE'A DEL TOBO'SO,** Sp. pron. dool'thē-nā'a dēl tō-bō'sō. The romantic title given by Don Quixote to the peasant's daughter Aldoriza Lorenzo, who was born at Toboso, and whom he selects as his lady, and whose champion he becomes. The name Dulcinea is a popular term for a lady love.

**DUL'CINISTS.** The followers of Dolcino. See APOSTOLIC BRETHREN.

**DULK,** dulk, ALBERT FREDERICK BENNO (1819-84). A German author. He was born in Königsberg and studied medicine and the natural sciences in that city and in Leipzig and Breslau. He took an active part in the popular uprising of 1848, at which time his revolutionary drama *Lea*, closely related to Hauff's tale *Jud Süß*, appeared. Dulk was a very eccentric, although quite talented, man. His doctrines of free love, personally and more or less openly put into practice, did not help his influence. After traveling in the Orient he settled in Geneva in 1850, and subsequently in Stuttgart, where he wrote the dramas *Jesus der Christ* (1865) and *Simson* (1859), in which play the conflict between Judaism and paganism is depicted. One of his later dramas, *König Enzo*, was set to music by Abert. His earlier dramas are somewhat superficial and very realistic, his later ones, e.g., *Willa* (1875), approach more nearly the norm. As an adherent of socialism, he became conspicuous, in 1871, through his opposition to the war with France, and his publications *Patriotismus* and *Frömmigkeit* obtained a wide circulation. In 1822 he founded in Stuttgart the first society of freethinkers in Germany, and during the last years of his life devoted his pen principally to the discussion of the radical side of religious-philosophical subjects. *Der Irrgang des Lebens Jesu* (2 vols., 1884-85) showed his irreconcilable differences with Christian doctrines and views of life. His complete dramatic works were issued in 3 vols., 1893-94. Consult Ernst Ziel, *Albert Dulk, sein Leben und seine Werke* (1895).

**DÜLKEN,** dül'ken. A town in the Rhine Province, Prussia, Germany, 20 miles west of Düsseldorf. It is a thriving industrial town, with iron foundries and manufactures of ma-

chinery, silk, velvet, cotton, linen, dyestuffs, and cigars. Pop., 1900, 9517; 1910, 10,517.

**DULLER**, dool'ler, EDUARD (1809-53). A German historian, politician, and poet. He was born and educated in Vienna. Notwithstanding the success of his drama, *Meister Pilgram*, which was publicly performed before the author was 19, he left Austria and went to Germany in 1830, residing successively in Munich, Frankfurt, Darmstadt, and Mainz, where he was appointed preacher in the German Catholic church (1851). He took a prominent part in the German Catholic movement and was a strenuous defender of religious liberty. He contributed the libretto to Mangold's opera *Tannhäuser*. Besides several meritorious lyrical and dramatic productions, he published the following standard historical works: *Vaterländische Geschichte* (5 vols., 1852-57; subsequently concluded by Hagen); *Geschichte des deutschen Volks* (7th ed., 1891); *Geschichte der Jesuiten* (1845; latest ed., 1893).

**DULONG**, du'lon', PIERRE LOUIS (1785-1838). A French physicist and chemist, known chiefly for the law which he discovered, jointly with Petit, in 1819. According to the law of Dulong and Petit, the specific heat of an element, multiplied by its atomic weight, is the same for all solid elements. The law was established empirically, and no theoretical explanation of it has yet been found. Dulong received his education at the Ecole Polytechnique, where he became, in 1820, professor of physics. In 1823 he was admitted into the Academy of Sciences. While investigating the composition of the chloride of arsenic, he lost an eye through the explosion of a quantity of this substance.

**DULONG AND PETIT**, pe-té', LAW OF. See ATOMIC WEIGHTS; DULONG.

**DULSE** (Gael. *duileasg*, dulse, from *duille*, leaf + *uisge*, water), *Rhodymenia palmata*. An edible seaweed, of the family Rhodymeniaceæ, which grows on rocky marine coasts. It is used as an article of food by poor people on the coasts of the British Isles and other northern countries, and occasionally also as a luxury by some of the wealthier classes who have acquired a taste for it. It has a purple, leathery or somewhat membranous, veinless, sessile leaf, irregularly cut, with repeatedly forked segments, which are either entire at the edges or furnished with lateral leaflets. The spores are distributed in cloudlike spots over the whole leaf. The name "dulse" is also given in the southwest of England to another seaweed, *Iridaea edulis*, one of the Ceramiaceæ, which has an undivided, obovate, or wedge-shaped, expanded, very succulent leaf, of a dull purple color. It is occasionally employed as food both in the southwest of England and in Scotland. *Laurencia pinnatifida*, of the Rhodomelaceæ, has a compressed, cartilaginous, twice or thrice pinnatifid leaf. It has a pungent taste and is used as a condiment when other seaweeds are eaten. In Alaska the name "dulse" is given to the seaweed *Porphyra laciniata*. It is gathered, pressed into cakes, and dried. When desired for use, it is broken or shaved into hot water and cooked for half an hour, when a nourishing porridge is obtained. Similar uses of this and related plants are reported from Japan, China, and elsewhere along the Pacific coasts.

**DULUTH**, du'looth'. A city and lake port, the county seat of St. Louis Co., Minn., at the western end of Lake Superior, 152 miles

north-northeast of St. Paul, separated from Superior, Wis., only by the St. Louis River (Map: Minnesota, F 4). The city is especially favored with facilities for transportation by rail and water. It is the terminus of the Northern Pacific, the Chicago and Northwestern, the Great Northern, and on the Chicago, Milwaukee, and St. Paul, the Duluth and Iron Range, the Duluth, Missabe, and Northern, the Duluth South Shore and Atlantic, the Duluth, Winnipeg, and Pacific, and the Minneapolis, St. Paul, and Sault Ste. Marie railroads, and of several steamship lines. Duluth has a natural harbor, 9 miles long and 2 miles wide, entrance to which is made by two canals—the principal one being at Duluth, the other 7 miles south—both piercing the narrow strip of land, called Minnesota Point, which separates the lake from the harbor. The city's trade by water is greatly facilitated by the Sault Ste. Marie Canal (the traffic of which greatly exceeds that of the Suez Canal) and is considerably increased by the fact that this is the nearest shipping city on the lakes for the Northwest. Duluth now ranks among the leading shipping points in the United States, the total yearly traffic of the combined port of Duluth-Superior being in 1913 about 50,000,000 tons. Its exports amounted in 1913 to \$2,876,722, of which lumber, flour, iron ore, and grain are the most important; the imports were valued at \$1,278,452. It has a large steel plant, a blast furnace, iron works, cement factory, machine shops, match factories, saw mills, flour mills, and other industrial works. The city has abundant water power, containing a plant with a minimum of 55,000 electric horse power developed from the St. Louis River, under a fall of 378 feet. Duluth is the seat of Protestant Episcopal and Roman Catholic bishops. It has a Carnegie library of 60,000 volumes, State normal school, United States Fisheries building, United States customhouse, county work farm (for minor offenders), a hydrographic office, and an aerial bridge, spanning the ship canal. There are 400 acres of parks and 20 miles of boulevards. Lester, Lincoln, Fairmount, and Chester parks, and Rogers Boulevard, a drive 500 feet above the lake, command beautiful views. Fond du Lac, a suburb at the head of navigation from Lake Superior, is one of the oldest towns in Minnesota, having been the site of the Astor trading post in 1752.

Duluth adopted the commission form of government in December, 1912, consisting of a mayor and four commissioners, elected at large for four-year terms. This body appoints all subordinate officers except judges of the municipal court, who are elected by popular vote. The city owns and operates its water works and gas plant. The annual income in 1912 was \$2,974,000; annual expenditure (including amounts for schools which are separately administered through a school district independent of the municipality), \$2,937,000; the principal items of expense were: education, \$469,000; fire department, \$180,000; water works, \$113,000; and police department, \$108,000. Duluth was first permanently settled in 1853, and takes its name from Daniel de Greydon, Sieur du Luth, who in 1679-80 visited this vicinity. It was only ceded by the Indians in 1855, received its charter as a town two years later, and in 1870, with a population of about 3000, it was incorporated as a city. Since then

its growth has been very rapid, a population of 3483 in 1880 having increased to 52,969 in 1900 and to 78,466 in 1910. Of this number 30,652 persons were of foreign birth and 410 of negro descent. The estimated (U. S.) population in 1914 was 89,331.

**DU LUTH**, DANIEL DE GRECYLON (1649-c.1709). A French explorer, born at Saint-Germain-en-Laye, France. He joined the royal guard, and later was commissioned a captain and sent to Canada, but he returned to France in 1674 to take part in the campaign against William of Orange. When again in Montreal, he organized an expedition which, leaving Sept. 1, 1678, arrived at the head of Lake Superior July 10, 1679, having spent the winter at Lake Huron. Du Luth established friendly relations with the Sioux Indians, visited Lake Winnipeg during the summer, and in September held a council of the chiefs of warring tribes. In June, 1680, he went to Fond du Lac, crossed over to the Mississippi River, and obtained the release of Father Hennepin and his two companions who had been prisoners among the Sioux. In 1695 he commanded Fort Frontenac. The city of Duluth was named in honor of this man, who was possibly the first to explore the region which later was known as the State of Minnesota.

**DULWICH**, dū'lich. A suburb of London, in Surrey, 4 miles south-southeast of St Paul's Cathedral and near Sydenham (Map: London, F 7). It is chiefly notable for its college and fine picture gallery. Dulwich College, or the College of God's Gift, was founded in 1619 by the actor, Edward Alleyn, who is buried in the chapel. The picture gallery was bequeathed to the college by the painter Sir Peter F. Bourgeois and is noteworthy for its works by Dutch masters. Pop., 1901, 13,359; 1911, 14,975.

**DUMA** (Russ., Council). The Lower House of the Russian Parliament. The first Duma, or general representative council, met in 1906. The suffrage qualifications were made quite low, and, according to the Czar's promise, responsible government was to be granted, and no law made effective without the Duma's consent. The old Council of the Empire was converted to an Upper House of Parliament, and the Duma was made the Lower in accordance with the usual constitutional practice of the Continent. Despite this arrangement, however, the government paid no attention to the demands of this Lower House, continuing vigorously the persecution of the Jews; and in the meanwhile anarchy prevailed in Russia, with serious revolts in Sebastopol and Moscow. The Duma criticized freely the actions of the government and the Czar's friends, whereupon it was promptly dissolved. The next year a new Duma assembled, but, as a majority of the former body were declared ineligible (by government fiat), it was more conservative in tone. The police, nevertheless, attempted to arrest several of its members. The Duma resisted and, like its predecessor, was dissolved for contumacy. In defiance of constitutional guarantees the election regulations were now changed. Poland lost two-thirds of her representatives, while the quotas from the great cities and the peasantry were also diminished. The third Duma, which met in 1907, largely composed as it was of priests, large land proprietors, and retired officials, proved itself almost, if not quite, subservient, and since that date the Russian Dumas,

their power largely emasculated, their membership strictly regulated, have been easily managed by the autocracy. See RUSSIA.

**DUMAGUETE**, dōō'mā-gā'tā. The capital of the Province of Negros Oriental, on the island of Negros, Philippines (Map: Philippine Islands, H 10). It is situated in a flat region on the southeast coast of the island, 66 miles south-southeast of Bacólod. The chief industries are the gathering of turtle shells and trading in cotton. Pop., 1903, 14,894.

**DUMANGAS**, dōō-mān'gās. A town of Panay, Philippines, in the Province of Iloilo, on the Dumangas, one of the reaches of the Jalour River, 13 miles northeast of Iloilo (Map: Philippine Islands, D 5). It is situated in a fertile and well-watered region. The town was founded in 1572. Pop., 1903, 12,428.

**DUMANJUG**, dōō'mān-hōōg'. A town of Cebu, Philippines, situated on the coast at the mouth of the river of the same name, 35 miles southwest of Cebu (Map: Philippine Islands, D 6). Pop., 1903, 22,203.

**DUMAS**, dū'mā', ADOLPHE (1806-61). A French author and poet, born at Chartreuse de Bon Pas, Vaucluse. He wrote: *Les Parisiennes* (1830); *La cité des hommes* (1835); *Le camp des croisés* (1838). His poems, *Un liame de rasin* (1858), were written in the "langue d'oc."

**DUMAS**, ALEXANDRE, called DUMAS PÈRE (1802-70). The greatest French romantic novelist and the most universally read story-teller of the world, born at Villers-Cotterets, July 24, 1802. As a writer, he is remarkable for great creative rather than for artistic genius. Dumas was the son of the Marquis Alexandre Davy de la Pailleterie and a negress, both of Haiti; his father, Alexandre Davy de la Pailleterie Dumas, was for a time general under Napoleon. Dumas was a strange embodiment of the contrast and combination of the mental and physical characteristics of his grandparents. His awkward age and calf love are painted ingeniously in his *Mémoires* and in *Ange-Pitou*. He inclined at first to law and was apprenticed to a notary of Soissons, where he saw, in 1819, a play of Ducis (q.v.) that determined him to seek his fortune on the stage. He reached Paris in 1823, with 20 francs and hope for all his patrimony. He found a temporary livelihood as secretary in the household of the future king, Louis Philippe, and in 1829 was among the first to begin the romantic revolt on the stage in his *Henri III et sa cour*, the first real triumph of the Romanticist school. Actively engaged in the revolution of 1830, he proved a too ebullient Republican to find favor in the royal household and resigned his post. He now produced the first of his historical novels, *Isabelle de Bavière*, out of which there grew in his fertile brain a scheme for turning the whole history of France into a sort of human comedy that should "exalt history to the height of fiction" and let a romantic fancy play around the evidences of the past. The *Chroniques de France* that resulted from this idea are Dumas's best work. They exhibit, indeed, no historic insight and no grasp of character; but they show a wonderful dramatic instinct to fuse and recast historic materials into chaplets of episodes that are by turns frolicsome and wild, extravagant, breathless, and impetuous, subordinating description to dialogue and everything to action, never failing to absorb the reader and to excite an intense curiosity. In

their historical order these chronicles are: *Le bâtard de Mauléon*; *Duguesclin*; *Isabelle de Bavière*; *La reine Margot*; *La dame de Montsoreau*; *Les quarante-cinq*; *Les trois mousquetaires* (the best); *Vingt ans après*; *Le vicomte de Bragelonne*; *La chevalier d'Hermant*; *Une fille du régent*; *Joseph Balsamo*; *Le collier de la reine*; *Ange-Pitou*; *La comtesse de Charny*; *Le chevalier de Maison-Rouge*; *Les blancs et les bleus*; *Les compagnons de Jésus*; and *La rose rouge*—the whole forming a series of well-nigh 100 volumes, which have served as models for the present-day cheaper novels of adventure and wild passion.

Dumas took his material where he found it, having barbaric ideas of literary property. Already in 1832 a well-founded accusation of plagiarism had forced him to travels, of which he has left a lively series of *Impressions*. (Consult Wormeley, *Journeys with Dumas*, Boston, 1902.) It did not lead him to mend his ways, however. Volumes have been written about his "novel factory," of his purchase of work by unknown authors or translators, and of publishing under his name what he had not so much as read (consult Quérard's *Les supercheries littéraires*, 1859); though these charges have been grossly exaggerated. He was always ready to buy ideas, he was willing to buy novels and rewrite them, he also supplied ideas and let others do the mechanical work of composition, and in later life he may have been even less scrupulous; but none who claimed to share his honor as well as his profits ever did under their own names work like that which they claim to have done for him, and we know that Dumas was as rapid and industrious a penman as he was a facile composer. No doubt he squandered his genius under the urgent demands of the press. Nor did he confine himself to novel writing; he was a most forceful figure in the Romantic drama. His *Antony* (1831) introduced the modern social play and popularized the pale-faced, dark-haired, wicked Byronic hero in France. His melodramatic *Tour de Nesle* (1832) reeked with mystery and crime.

Although his best work was almost all done between 1843 and 1850, in one way or another Dumas is responsible for 298 somewhat closely printed volumes. For a generation he was the world's Scheherazade, doing more than all others together to give French fiction a cosmopolitan audience in the great middle class, while he also found admirers among the highly cultured, such as Thackeray. His work brought enormous returns, but he was a phenomenon of thriftlessness. He became involved in many lawsuits over contracts signed with thoughtless levity. He built a palace, Monte Cristo, for 500,000 francs in 1847, then sold it in 1851, and fled from his creditors in 1853. Then for 19 years he became a pathetic wanderer in search of "copy." He visited England (1857), Russia and the Caucasus (1858), and Italy (1860 and 1866). Last came four years of senile poverty, relieved by the son whose boyhood he had neglected and whose youth he had misguided. By him he was taken from the excitements and dangers of Paris in war time to Puy, near Dieppe, where he died on the day of its occupation by the Prussians, Dec. 5, 1870. He was buried in 1872 at his boyhood's home in Villers-Cotterets. A uniform and nearly complete translation of Dumas's novels is published in Boston. Consult: Blaze de Bury, *Alexandre*

*Dumas, sa vie, son temps, son œuvre* (Paris, 1885); Wells, *A Century of French Fiction* (New York, 1898); Parigot, *Le drame d'Alexandre Dumas* (Paris, 1898); id., *Alexandre Dumas père* (ib., 1902); A. B. Davidson, *Alexandre Dumas père, his Life and Works, with Bibliography* (New York, 1902); A. Maurel, *Les trois Dumas (Le général, A. Dumas père, et fils)* (Paris, 1896).

**DUMAS, ALEXANDRE**, called **DUMAS FILS** (1824-95). One of the most distinguished of modern French dramatists. He was born in Paris, July 27, 1824, the son of the great romantic novelist of like name, but of a genius strangely contrasted. In him the father's rich but riotous fancy yielded to close observation and realistic earnestness that made of him an unbending and almost a Puritan moralist. Like his grandfather, an illegitimate child, he has drawn, in *L'Affaire Clémenceau* (novel, 1867; dramatized, 1887), a moving picture of the torments caused by his origin during his school life. Later he became the companion and associate of his bohemian father and after a brief carnival found himself, in 1848, with 50,000 francs of debt and a pen for his assets. He left old associations forever behind, sold his experience to the world in a novel, *La dame aux camélias* (1848; dramatized, 1852), and became a serious, hard-working author and soon an independent and wealthy one. His other early novels and a first dramatic essay (1845) are romantic commonplace and have no value. But the dramatization of *La dame aux camélias* marks a date (Feb. 2, 1852) in the history of the French stage and inaugurates the realistic study of social problems that has changed the face of the modern drama. Dumas joined Balzac's insight into character to Scribe's technical attitude and to an instinct that truth, to be dramatically effective, must be logical and conventional in its exhibition. In so far Dumas is not a naturalist, though he is eminently a dramatic realist. He was the sponsor for the "comedy of manners" which was widely imitated by the dramatists of his period, especially in Germany. His other plays, in their order, are: *Diane de Lys* (1853); *Le demi-monde* (1855); *La question d'argent* (1857); *Le fils naturel* (1858); *Un père prodigue* (1859); *L'Ami des femmes* (1864); *Les idées de Madame Aubray* (1867); *Une visite de noces* (1871); *La princesse Georges* (1871); *La femme de Claude* (1873); *Monsieur Alphonse* (1873); *L'Etrangère* (1876); *La princesse de Bagdad* (1881); *Demise* (1885); *Francillon* (1887). Their perennial theme is the baneful influence of romantic love, false sentiment, and chivalrous passion. *La dame aux camélias* had shown him disposed to an open-armed charity towards ladies of easy virtue who aspired to a virginity of the heart after the manner of Prévo's Manon Lescaut and Hugo's Marion de Lorme and Fantine (*Les misérables*). But *Diane* shows sterner stuff, and all the dramas that follow are social sermons, each provided with a frank and forceful preface to enforce its lesson of warning against the women of that type.

In general, the dramas are rather gloomy pictures of relations that, as one of his heroines remarks, "began because I was bored and ended because he bored me." They are very witty, but the wit is not kindly, and often it is too didactic. The style is a marvel of conciseness and clearness, "all muscles, nerves, and action"; the language was at first incorrect, and to the

last full of new-coined phrases; the characters are apt to be abstractions, types repeated over and over. Clémenceau's wife, Iza, e.g., is the Countess of Terremonde in *La princesse Georges*, and the Valentine of *Le demi-monde* and the incarnate Beast of *La femme de Claude*. His *Les idées de Madame Aubray* marks him as a pioneer in the field of problem plays. But, after all reserves have been made, the son of the author of *Monte Cristo* was the most purposeful, forceful, and serious of the French dramatists of the nineteenth century. He died at Marly-le-Roi, Nov. 27, 1895.

Dumas's dramas are collected in seven volumes (1890-93), with two volumes of plays revised and adapted by him, *Le théâtre des autres*. Four volumes of essays, chiefly on social subjects, appear as *Entr'actes* (1878-90). Consult: Zola, *Nos auteurs dramatiques* (Paris, 1881); Bourget, *Essais de psychologie contemporaine* (ib., 1883); Doumic, *Portraits d'écrivains* (ib., 1892); Matthews, *French Dramatists* (New York, 1901); H. d'Alméras, *Avant la gloire* (Poitiers, 1902); C. M. Noel, *Les idées sociales dans le théâtre de A. Dumas fils* (Paris, 1912).

**DUMAS, GUILLAUME MATTHIEU**, COUNT (1753-1837). A French general, politician, and military historian, born at Montpellier, Nov. 23, 1753. After receiving a military education, he became in 1776 a captain of chasseurs, and in 1780 accompanied the Comte de Rochambeau to America as aid-de-camp and took part in the principal actions of the war, including the siege of Yorktown. He returned to France with the rank of major. After executing a military investigation in the Levant, and a mission of observation in connection with the Dutch revolution of 1787, he was raised to a colonelcy. He was Lafayette's aid-de-camp in 1789 and sided with the Constitutional Liberal party. In 1791 he was elected to the Constituent Assembly and the next year was chosen President of that body. During the Reign of Terror he absented himself from France, with some brief intervals. In 1797 he was proscribed as a monarchist and fled to Holstein. When Bonaparte became First Consul, Dumas was recalled and appointed chief of staff to the army of Dijon. He was subsequently Councilor of State, grand officer of the Legion of Honor, and general of division. In this last capacity he was present at the capitulation of Ulm and the battle of Austerlitz (q.v.), in the latter of which he distinguished himself by high courage and dashing tactics. In 1806 he went with Joseph Bonaparte to Naples and was made Minister of War. In 1808-09 he served in the French army in Spain and Germany, and after the battle of Wagram he was employed in negotiating an armistice with Austria. In 1810 he was made a count of the Empire. In the Russian campaign of 1812 Dumas filled the arduous post of intendant general, and after the retreat he fought at Lützen and Bautzen. Subsequent to the defeat at Leipzig he was intrusted with the task of arranging for the capitulation of Dresden; but his conditions were not accepted by the Allied Powers, and he was arrested and imprisoned until the conclusion of peace in 1814. He was in favor under the first Bourbon Restoration and held important commissions. Upon Napoleon's return from Elba Dumas was persuaded to take charge of the organization of the National Guard. When Louis XVIII returned, Dumas was obliged to retire on half pay. In 1818 he was restored to favor and made, for a

short time, a member of the Council of State, and in 1823 was a deputy in the Chamber from Paris. After the events of 1830, in which he took a prominent part, he was made a peer, reentered the Council of State, and became president of the War Committee. He died Oct. 16, 1837. Besides an important military history, *Précis des événements militaires, 1793-1807* (19 vols., Paris, 1817-26), Dumas left an autobiographical work, *Souvenirs du lieutenant-général comte Matthieu Dumas, 1770 à 1836* (Paris, 1839; Eng. trans., Philadelphia, 1839-40).

**DUMAS, JEAN BAPTISTE** (1800-84). A distinguished French chemist, born at Alais, in the Department of Gard. He was at first apprenticed to an apothecary in Geneva and engaged in some scientific work there that attracted the attention of Berzelius and Prévost. In 1823 he went to Paris and was appointed chemical *répétiteur* (tutor) in the Ecole Polytechnique, and then professor of chemistry in the Athenaeum. He was afterward transferred to the Sorbonne and made a member of the Academy of Sciences. His researches on atomic weights, sulphuric ether, and the phenomena of substitution in organic chemistry attracted attention over all Europe. During the July monarchy he was a member of the Council of Education. After the revolution of February he was chosen a member of the Legislative Assembly, and from 1849 to 1851 he held the portfolio of Agriculture and Commerce. After the coup d'état he was made a member of the Senate and of the Superior Council of Public Instruction. Numerous contributions from his pen are contained in the *Annales de l'Industrie* and other scientific journals, including the *Mémoires de l'Académie*. His chief works are: *Traité de chimie appliquée aux arts* (8 vols., 1828-45); *Leçons sur la philosophie chimique* (1837); *Essai sur la statique chimique des êtres organisés* (1841; 3d ed., 1844); etc. Dumas delivered the first Faraday lecture before the London Chemical Society, in 1869. Consult Hofmann, *Zur Erinnerung an Jean Baptiste Dumas* (Berlin, 1885). See CHEMISTRY, History.

**DU MAURIER, du mō'ryā'**, GEORGE LOUIS PALMELLA BUSSON (1834-96). An English illustrator and novelist, born in Paris. On his father's side he was of French descent; his mother was English. His boyhood was passed in London, Boulogne, and Paris, and at the age of 17 he took up the study of chemistry in University College, London. On the death of his father (1856) Du Maurier adopted art as his profession, studying in Paris under Gleyre and in Antwerp under De Kaiser and Van Lerius. In 1859, while drawing in the studio, he suddenly lost the sight of one eye, and during the rest of his life worked under the menace of total blindness. Returning to London, he began drawing for *Once a Week*, *Punch*, and the *Concubine Magazine*, and on the death of Leach (1864) he became permanently attached to *Punch*, to whose pages he contributed those examples of social satiric art now so well known. For his drawings he himself composed the clever legends. He also illustrated Thackeray's *Henry Esmond* and *Ballads*, and works by Henry James, Thomas Hardy, George Meredith, Mrs. Gaskell, and others. To *Harper's Magazine* he contributed a series of drawings and two novels—*Peter Ibbetson* (1891) and *Trilby* (1894). The former, a fanciful romance of dream life, was widely read—chiefly, it would appear, through interest

in the autobiographic record of the author's life at Passy. The latter, whose scene is the Quartier Latin, met with phenomenal success and was dramatized in both England and America. Whatever may be thought of the melodramatic presence of Svengali, the study of the artist trio, occupying the earlier portion of the story, is generally regarded as a genuine achievement. Subsequently to Du Maurier's death a third novel, *The Martian*, appeared in *Harper's* (1896-97). He was also a skillful writer of light verse, specimens of which appeared in *Punch* and dispersed through his books. But his reputation will chiefly rest upon that illustrative work for *Punch* through which he smilingly assailed the snobbish and the mean in the fashionable and artistic world, and which, by its copiousness of detail, forms a valuable historical storehouse for the future student of English manners and customs of his period. His drawings possess much grace, charm, and finish, and his peculiar type of woman became known everywhere.

#### DUMB. See DEAF-MUTE.

**DUMB AGUE.** A common name of a form of intermittent fever in which there is a cold sensation in place of the shaking chill, and the succeeding fever is present; or of chronic malarial infection in which there is no regular chill, fever, and sweat, but all other conditions are present. See INTERMITTENT FEVER.

**DUMBARTON**, dūm-bārt'n, or DUNBARTON (Gael. *Dumbreaton*, fort of the Britons; called by the Britons *Alcluth*, height on the Clyde). A royal, parliamentary, and municipal burgh, port, and capital of the County of Dumfries, Scotland, on the Leven, near its junction with the Clyde, 15 miles west-northwest of Glasgow (Map: Scotland, D 4). It consists chiefly of a long semicircular street parallel to the river. Its principal public buildings are the Dumbarton Academy and county building. Shipbuilding, marine-engine and machine making, iron forging, iron and brass founding, and rope making are the chief industries. It has regular steam communication with Glasgow, Greenock, and other Clyde ports. Pop. (municipal burgh), 1901, 19,985; 1911, 21,989. Dumbarton was called Alcluth (hill of the Clyde) by the Britons, and Dunbreatan (fort of the Britons) by the Celts, and was the capital of the British district of Strathclyde. The Romans had here a naval depôt, called Theodosia. Alexander II in 1221 made it a royal burgh. At the mouth of the Leven stands the castle of Dumbarton, on a steep, rugged, double-peaked basaltic rock, rising to the height of 240 feet. It is one of the four Scottish castles which, by the terms of the treaty of union between England and Scotland, must be maintained. Its armament now consists of a few obsolete cannon. It was for a time the prison of the Scottish hero Sir William Wallace and served as a residence for Mary, Queen of Scots, during her childhood, and prior to her departure for France. Consult Irving, *Dumbarton* (Dumbarton, 1865).

**DUMBARTONSHIRE.** A county in the west midland division of Scotland (Map: Scotland, D 3). Area, 267 square miles. The northern and western portions are mountainous, with many peaks from 2000 to 3000 feet high, and numerous lovely lakes—the largest, Loch Lomond. Here the scenery is indescribably beautiful. Well-cultivated lands lie south of Loch Lomond and along the Clyde east and

west of Dumbarton Castle. Turkey-red dyeing, bleaching and printing of calicoes, engine and ship building, distilling and brewing, and coal and ironstone mining are the chief industries. Pop., 1801, 20,700; 1851, 45,100; 1901, 113,865; 1911, 139,831. Capital, Dumbarton (q.v.). Consult Irving, *Dumbartonshire* (Dumbarton, 1860).

**DUMB-BELL** (so called from a fancied resemblance of the balls to bells). A weight used in calisthenic and other physical exercises. It consists of two balls of iron, or, for light exercise, of wood, connected by a bar for a handle. The present form of dumb-bell was in use in England as early as the reign of Queen Elizabeth; and weights, called *halteres*, that were similar to modern dumb-bells, were used by the quoit players in the early Grecian games. See GYMNASTICS.

**DUMDUM** (*damdama*, raised mound or battery). A town and military cantonment in the District of Twenty-Four Parganas, Bengal, British India, 10 miles southeast of Barrackpur and 5 miles northeast of Calcutta (Map: India, E 7). It has extensive accommodations for troops and a government ammunition factory. Here are manufactured the famous dumdum soft-nosed bullets, which flatten when they strike, tearing a large wound. The place is famous in connection with the mutiny of 1857. It was the scene of the first open manifestation on the part of the Sepoys against the greased cartridge. The raising and manufacture of jute began about 1905. Pop., 1901, 20,830.

**DUMDUM BULLET.** A bullet sometimes used in the British army, where it is styled "Mark IV." It resembles the ordinary service bullet, except that the leaden core is left uncovered, and, by further making the casing weak at the apex, the bullet spreads out immediately on striking a bone and tears or splinters the body, usually with fatal results. It was first made at the Dumdum Arsenal in India. *Dumdum*, or *Damdama*, is the name of a town, in Bengal Presidency, noted for its arsenal and for the fact that the mutiny of 1857 broke out there. The reports of the commanding officers in the Chitral campaign of 1895 called attention to the fact that, while the service small-bore bullet had immense penetrative power, it did not possess sufficient stopping power; and a man struck by it did not at once suffer shock or disablement, but continued to fight. The wound of the Lee-Metford (the British service rifle) bullet, like that of the Mauser, is a perfectly clean perforation, which in many instances will soon heal. It was to secure greater stopping power that the dumdum was employed. It is under the ban of the Peace Conference; Great Britain employed it, but only against uncivilized peoples, until the Second Peace Conference at The Hague, 1907. She then acceded to the declaration, so that the United States is now the only power remaining outside the operation of the declaration. The dumdum bullet, however, is not used in the United States army. It was used in Egypt in 1895, but not in the Boer-British War of 1899-1902.

**DUMÉRIL**, du'mā-rél', ANDRÉ MARIE CONSTANT (1774-1860). A French physician and naturalist, born at Amiens. In 1801 he was appointed professor of anatomy and physiology at the University of Paris, where in 1819 he also obtained the chair of internal pathology, which he occupied for more than 40 years. He was also at one time the substitute of Cuvier



in the department of natural history of the Ecole Centrale du Panthéon. It was, however, as assistant of Lacépède, in the course of herpetology and ichthyology, at the Jardin des Plantes, that he obtained that wide experience and extensive information which enabled him to write the first comprehensive work on reptiles, entitled *Erpétologie générale, ou histoire naturelle complète des reptiles*, in collaboration with Bibron (1834-54). His other publications include: *Traité élémentaire d'histoire naturelle* (1804; 2d ed., 1807); *Zoologie analytique* (1806); *L'Ichthyologie analytique* (1856).

**DUMÉRIL, AUGUSTE HENRI ANDRÉ** (1812-70). A French naturalist, son of André M. C. Duméril. He was born in Paris and studied medicine at the university in that city. In 1847 he was appointed professor of geology at the Collège Chaptal, and 10 years later he succeeded his father as director of the Museum of Natural History. He assisted in the preparation of his father's *Erpétologie* and wrote *Des odeurs* (1843); *De la texture intime des glandes* (1845); *Histoire naturelle des poissons* (1865-70).

**DUMÉRIL, EDELESTAND PONTAS** (1801-71). A French philologist. He was born at Valognes, Normandy, and subsequently removed to Paris. After publishing *La mort de Garin le Loharain* and other examples of mediæval French text, he began the collection of mediæval Latin poetry, published under the respective titles *Poésies latines antérieures au XII<sup>ème</sup> siècle* (1843) and *Poésies latines du moyen âge* (1847). These works won for him a wide reputation as a Latinist. As an archaeologist and historian of literature, he published: *Essai sur l'origine des runes* (1844); *Origines latines du théâtre moderne* (1849); *Des formes du mariage pendant le moyen âge* (1861); *Histoire de la comédie* (1864-67).

**DUMERSAN, du'mâr'sân', THÉOPHILE MARION** (1780-1849). A French numismatist and playwright, born in the castle of Castelnaud, near Issoudun, Indre. In 1842 he was appointed director of the royal cabinet of coins, after an association of nearly 50 years with that establishment. He wrote about 230 vaudevilles, among which *L'Ange et le diable*, a drama in five acts, was very popular. His best work, however, and one which is still referred to as a model of its kind, is the play entitled *Les saltimbanques* (1838). His principal work on numismatics is the *Notice des monuments exposés dans le cabinet des médailles et antiques* (1829; frequent subsequent editions).

**DUMESNIL, du'mâ'nél', MARIE FRANÇOISE** (1713-1803). A celebrated French tragic actress whose real name was Marchand. According to the usual account, she was born in Paris, but her first experience upon the stage was gained in the provinces, at Strassburg and elsewhere. She made her début in the Théâtre Français in 1737 as Clytemnestra in *Iphigénie*. Her imposing appearance, and power of tragic expression gave her immense control over her audiences. Once, it is related, those in the front seats were so overcome with horror that they fairly retreated before her, leaving their places vacant. Her superiority to her rival, Mademoiselle Clairon, is generally acknowledged, though there were critics who resented the innovations of her forceful genius. Among her great parts were Athalie, Phèdre, Médée, Sémiramis, and especially Mérope, which won for her both the admiration

and the gratitude of Voltaire, its author. She continued upon the stage till 1776, when she retired upon a pension largely supplemented by the favor of the court. She died at Boulogne-sur-Mer. Consult Coste d'Arnobat, *Mémoire de Marie Françoise Dumesnil* (Paris, 1800), written in reply to an attack upon her by Mademoiselle Clairon.

**DUMFRIES, düm-frēs'.** A royal parliamentary and municipal burgh, river port, and the capital of Dumfriesshire, Scotland, on the Nith, 9 miles from its mouth in the Solway Firth, 73 miles south-southwest of Glasgow, and 33 miles west-northwest of Edinburgh (Scotland, E 4). It stands on rising ground, surrounded, except towards the sea, by fine, undulating hills, and is irregularly built of red freestone. One of the bridges across the Nith is believed to have been built about 1280 by Devorgilla, daughter of John Baliol, who also erected a monastery in the chapel of which, in 1306, Robert the Bruce slew the Red Comyn. The region is associated with incidents in the life of Robert Burns, who was buried in St. Michael's churchyard. The houses in which he lived and the one in which he died are marked with tablets. Among the modern buildings may be mentioned the county building, a Scottish baronial structure, the post office, Crichton Institution, and the general infirmary. The municipality owns the water works, gas works, and public baths and workhouses. The chief industry is the manufacture of tweeds, hosiery, leather, baskets, and wooden shoes. Its cattle fairs are also of importance, and an import trade is carried on in oilseed cake, beans, and manures. Two objects of interest in the neighborhood are the ruins of Lincluden Abbey and Caerlaverock Castle, an ancient stronghold of the Maxwells, and the Ellangowan in *Guy Mannering*. Dumfries is believed to have grown up about an ancient British fortress. It was made a royal burgh by William the Lion. It suffered severely during the Border wars. In 1745 it was the headquarters of the Young Pretender, who raised the town's funds. Pop. (royal burgh, 1801, 15,514; 1911, 16,011. Consult Maxwell, *History of Dumfries* (Edinburgh, 1896).

**DUMFRIESSHIRE.** A border county in the southern division of Scotland (Map: Scotland, E 4). It has 21 miles of coast line on the Solway Firth, toward which its surface slopes from the northern portion, which is mountainous. The principal rivers are the Nith, Annan, and Esk, the valleys of which form the "dales" of the corresponding names. Area, 1072 square miles. The mineral products are coal, limestone, ironstone, lead, and silver. There are extensive lead mines at Wanlockhead; limestone is quarried in the parishes of Keir and Carmertrees; zinc ore is mined at Abington, and coal at Sanquhar and Canonbie. The chief occupations are agriculture and the raising of cattle, sheep, and swine. Sheep farms occupy the hills. There are salmon fisheries in the rivers. Pop., 1801, 54,600; 1851, 78,100; 1891, 74,245; 1901, 72,570; 1911, 72,825. Capital, Dumfries (q.v.).

**DÜMICHEN, du'mik-en. JOHANNES** (1833-94). A German Egyptologist, a pupil of Lepsius and Brugsch. His numerous works consist almost entirely of editions of Egyptian inscriptions, derived from temples of the Greek and Roman period. He devoted special attention to the very complicated and difficult hieroglyphic



writing which prevailed during this period. In 1872 he was appointed professor of Egyptology at *St. Andrews*. Among his works may be mentioned: *Geographische Inschriften altägyptischer Denkmäler* (1866); *Altägyptische Kalenderinschriften* (1866); *Historische Inschriften altägyptischer Denkmäler* (1867-68); *Der Felsentempel von Abu Simbel* (1869); *Der Grabpalast des Patuamenap in der thebanischen Nekropolis* (1884-94).

**DUMMER, JEREMIAH** (1680-1739). An American clergyman, who spent the latter part of his life as a politician and lawyer in England. He was born in Boston, the brother of William Dummer, acting Governor of Massachusetts from 1723 to 1728, graduated at Harvard in 1699, and took his doctor's degree at Utrecht in 1703. After preaching for a time in Boston he moved to England, where he left the ministry, practiced law, and became a political lieutenant of Bolingbroke. He rendered valuable services to the Colony of Massachusetts, for which he was the London agent from 1709 to 1721. He is best known as the author of an able *Defense of the New England Charters* (1728), written at a time when Parliament seemed about to annul several of the Colonial charters. He also published *A Discourse on the Holiness of the Sabbath Day* (1704) and *A Letter to a Noble Lord Concerning the Late Expeditions to Canada* (1709). Consult a brief sketch in Tyler, *A History of American Literature to 1765* (New York, 1876).

**DUMMER'S WAR** (so called from William Dummer, acting Governor of Massachusetts from 1723 to 1728). A war (1723-25), originating in a dispute over boundary lines, between the Abnaki Indians and the border settlers of Vermont and Maine, then under the jurisdiction of Massachusetts. It was marked by numerous petty skirmishes and by two considerable engagements—one on Aug. 12, 1724, when a company of 208 whites massacred the Jesuit missionary Rale and some 26 Indians, and another on May 8, 1725, when 34 whites under Capt. John Lovewell defeated a much larger body of Indians, after a bloody contest on the site of the present Fryeburg, Me. Peace was concluded in November, 1725. For a brief account of the war, consult Parkman, *A Century of Conflict* (Boston, 1892).

**DÜMMLER, dum'ler**, ERNST LUDWIG (1830-1902). A German historian. He was born in Berlin and was educated at the universities of Bonn and Berlin. In 1858 he became professor of history at Halle. In 1876 he became president of the Historical Commission for the Province of Saxony, and in 1888 he was chairman of the editorial board of the *Monumenta Germaniae Historica* in Berlin. His publications include: *Geschichte des ostfränkischen Reiches* (3 vols., 2d ed., 1887), for which two prizes were awarded him by German academies; *Kaiser Otto der Grosse* (1876); *Auilius und Vulgarius: Quellen und Forschungen des Papsttums im Anfang des zehnten Jahrhunderts* (1866); and numerous important contributions to the *Monumenta Germaniae Historica* and similar publications.

**DUMONCEAU, du'môn'sô'**, JEAN BAPTISTE, COUNT BERGENDAEL (1760-1821). A French soldier, born in Brussels. He was colonel of a regiment during the revolt of Brabant against Austria. Upon the suppression of the rebellion he fled to France and afterward fought at Jemappes and Neerwinden. In consequence of the bravery and skill displayed by him in these

important battles he was successively promoted to the rank of brigadier general (1793), commandant of Amsterdam (1794), and lieutenant general of the Batavian Republic (1795). In 1807 he became marshal of Holland, in which capacity he successfully conducted the operations against the English in Walcheren (1809). After the union of Holland with France he again distinguished himself in the campaigns of 1813. His valorous conduct made him a count. The title of "the Stainless General" was bestowed upon him by reason of his unsullied record as a soldier.

**DU MOND', FRANK VINCENT** (1865- ). An American figure and landscape painter. He was born in Rochester, N. Y., and studied in Paris under Boulanger, Lefebvre, and Benjamin Constant. His work, which includes religious pictures, landscapes, groups of young girls, and ideal paintings, has a distinctive quality; for he possesses the art of crowding much detail into harmonious masses. His color is delicate, his line sure. Among his most important paintings are: "The Baptism," "Portia," "An Italian Street," "July Afternoon" (1910); "October" (1911), and "The Margaree" and "Grassy Hill" (1913). He designed important illustrations for the *Century Magazine*, became influential as an instructor at the Art Students' League, New York, and was elected to the National Academy of Design in 1906.

**DUMONT.** See SANTOS-DUMONT.

**DUMONT, du'môn', ALBERT** (1842-84). A French archaeologist. He was born at Secy-sur-Saône (Haute-Saône) and was educated in Paris and at Athens. After lecturing on archæology and the history of art in Rome (1874) and at Athens, as director of the French School of Classical Studies there (1875-78), he became rector of the academies at Grenoble (1878) and Montpellier (1879), and occupied the position of superintendent of higher education until his death. His researches covered a wide field, embracing prehistoric as well as Christian and Byzantine archæology, while his treatment of the ceramic art of Greece reveals the profound scholar and keen, critical artist. Among his numerous important works are the following: *De Plumbis apud Græcos Tessaris* (1870); *Inscriptions céramiques de Grèce* (1871); *Vases peints de la Grèce propre* (1873); *Les céramiques de la Grèce propre, vases peints et terres cuites*, in collaboration with Chaplain (1882-90).

**DUMONT, AUGUSTIN ALEXANDRE** (1801-84). A French sculptor, born in Paris. He studied with his father, Jacques Edme Dumont (1761-1844), and with Cartellier. In 1823 he won the *Prix de Rome*, afterward spending some years in Italy. The works of Dumont are very numerous; they were mostly executed for the public buildings and churches of Paris, and are to be found in the Senate, the Hôtel de Ville, at Versailles, and in the churches of the Madeleine and Notre Dame de Lorette. His two best-known works are "The Genius of Liberty," a colossal statue in gilded bronze on the July Column (1840), and the colossal bronze statue of Napoleon I on the Vendôme Column, seriously damaged during the Commune, but since restored. Other important statues are those of Nicholas Poussin for the Palace of the Institute; Blanche de Castille in the Luxembourg Gardens; and St. Cecilia in the Madeleine; he is especially well represented in the Museum of Sémur. He was elected to the Institute in 1838, became

professor at the Ecole des Beaux-Arts in 1852, and received the grand medal of honor at the Exposition of 1855. The boldness and finish, combined with grace, that distinguish the works of this sculptor show the influence of Canova. Consult Vattier, *Une famille des artistes: Les Dumont* (Paris, 1890).

**DUMONT, PIERRE ETIENNE LOUIS** (1759-1829). A Swiss philosopher, the leading disciple of Bentham, and the great expositor of the Benthamite philosophy. He was born in Geneva, July 18, 1759, studied theology, and after officiating as a minister for a short time in his native town, proceeded to St. Petersburg in 1783, where he accepted the charge of the French Protestant church. In 1785 he left Russia, went to England, and became tutor to the sons of Lord Shelburne, afterward Marquis of Lansdowne. His superior talents, liberal sentiments, and fine character soon recommended him to the distinguished Whigs of that period; with Sir Samuel Romilly, in particular, he formed a close friendship. During the early years of the French Revolution Dumont was in Paris, where he became greatly attached to Mirabeau, regarding whom he has given the world much important information in his *Souvenirs sur Mirabeau et sur les deux premières assemblées législatives* (which were not published till 1832, three years after the author's death). In 1791 Dumont returned to England and formed an intimacy with Bentham. This led to the most important event in his life. Deeply convinced of the value of that philosopher's views on legislation, he requested his friend to allow him to arrange and edit his unpublished writings on this subject. Bentham gave him his manuscripts. Dumont labored earnestly and successfully to bring order out of the chaos of Bentham's writings and gave them a literary form and a currency which contributed powerfully to their influence. In the following works he appears as the interpreter as well as the editor of the philosopher: *Traité de législation civile et pénale* (Geneva, 1892); *Théorie des peines et des récompenses* (ib., 1810); *Tactique des assemblées législatives* (ib., 1815); *Preuves judiciaires* (ib., 1823); and the *Organisation judiciaire et codification* (1828). Dumont returned to Geneva in 1814 and became a member of the Representative Council. He died in 1829 in Milan. Consult Macaulay, *Review of Dumont's "Recollections of Mirabeau"* (London, 1832), and De Candolle, *Notice sur la vie et les écrits de M. Dumont* (Paris, 1829).

**DUMONT D'URVILLE, dur'vêl', JULES SÉBASTIEN CÉSAR** (1790-1842). A French navigator, the discoverer of a portion of the so-called Antarctic continent. In 1820, while on a surveying trip in the Mediterranean, he recognized the artistic value of a Grecian statue which had just been unearthed, and which is now known as the "Venus of Milo," and announced the discovery to the French government. In later years he was concerned in explorations around the Australian continent, New Zealand, Van Diemen's Land, and other Pacific and Indian islands for the purpose of finding traces of Lapérouse. In 1836 he submitted to Louis Philippe the plan of a new expedition which was to explore the Antarctic regions. Joinville Island and Louis Philippe Land were both discovered by him in 1838. After an extended cruise in the Pacific Ocean Dumont d'Urville returned to the far south, and on the afternoon

of Jan. 19, 1840, discovered a coast line in about lat. 65° S., long. 14° E. This he called Adélie Land. Clarie Land, a wall of ice, supposed by the Frenchmen to be attached to a land mass, was discovered on January 30. These two coasts are supposed by geographers to form part of the boundary of a great land, called for convenience Antarctica, or the Antarctic continent. Lieutenant Wilkes, of the United States exploring expedition, had sighted another portion of the same coast farther to the eastward early in the morning of January 19. D'Urville was appointed rear admiral on his return. Eighteen months afterward he was killed in a railroad accident. Among his publications are: *Rapport sur le voyage de "L'astrolabe" lu à l'Académie des sciences dans sa séance du 11 mai, 1829* (1829); *Voyage pittoresque autour du monde* (1834); *Voyages au pôle sud et dans l'Océanie* (1841-54).

**DUMORTIERITE, dû-môr'ti-êr-it.** A basic aluminium silicate that crystallizes in the orthorhombic system, has a vitreous lustre, and is of a bright blue to greenish-blue color. It occurs in fibrous forms in feldspar near Lyons, France, and also in Silesia and in Norway, while in the United States it is reported from the vicinity of New York City, from California, and from Yuma Co., Ariz. It is named after Eugène Dumortier, the French paleontologist.

**DUMOULIN, dû'moō'lân', CHARLES** (1500-66). A French jurist, born in Paris. He was a member of the Reformed congregation and became celebrated as a consulting lawyer. He published in 1552 his *Commentaire sur l'édit des petites dates*, a famous argument to show the justice of the action of Henry II of France in forbidding the exportation of gold and silver from the kingdom to Rome. This work was promptly condemned by the Sorbonne and won him the honor of a heresy trial. Soon after his return from Germany in 1557 he published the *Conseil sur le fait du concile de Trent*, which greatly offended both Catholics and Calvinists, and for which he was imprisoned until 1564. His writings, comprising 50 other titles, were published in Paris in 1581 in five folio volumes.

**DU MOULIN, JOHN PHILIP** (1834-1911). A Canadian Anglican bishop. He was born in Dublin, Ireland, but in early manhood came to Canada. He was educated at Trinity University, Toronto, and in 1863 was ordained a priest of the Church of England in Canada. He was curate of St. John's Church, London, Ontario, in 1862-66; of Holy Trinity Church, Montreal, in 1866-71; incumbent of St. Thomas's Church, Hamilton, Ontario, in 1872-75; and rector of St. Martin's Church, Montreal, in 1875-82. While incumbent at Hamilton, he was elected Bishop of Algoma, but declined the preferment. In 1882-86 he was rector and canon of St. James's Cathedral, Toronto, and in 1885-96, subdean of St. Alban's Cathedral in that city. He was a delegate to the Lambeth Conference, London, England, in 1897 and a delegate to the Pan-Anglican Congress in the same city in 1908. In 1906-07 he had a prominent part in compiling a hymnal for the use of the Church of England in Canada. He was widely known as an able and eloquent preacher. His principal publications were *Two Pillars of Empire* (1904) and *The Eternal Law* (1906), being the Slocum lectures for 1901 at the University of Michigan.

**DUMOURIEZ, dû'moō'rê'â', CHARLES FRANÇOIS** (1739-1823). A French general and poli-

tician, born at Cambrai, Jan. 25, 1739. His father was a commissary officer in the French army, and young Dumouriez obtained a commission and fought in the Seven Years' War, retiring in 1763 with the rank of captain, a small pension, and the cross of St. Louis. After some years spent in travel Dumouriez was appointed quartermaster-general to the Corsican expedition by the Duke de Choiseul and was later sent on a secret mission to Poland. Though employed by D'Aiguillon, the successor of Choiseul, Dumouriez fell into disgrace while on a mission in Sweden and spent the last months of Louis XV's reign in the Bastille and the Château at Caen. Under Louis XVI, however, he was made commandant at Cherbourg, where he commenced the creation of a great naval establishment. In 1788 he was made a major general, and on the outbreak of the Revolution attached himself at first to Lafayette and Mirabeau, but in 1790 became connected with the Jacobin Club and managed to secure a command in Normandy. In 1792 he became Minister of Foreign Affairs, but resigned to become lieutenant general of the Army of the North. He operated successfully against the Duke of Brunswick, who received a severe check at Valmy (September 20) and was forced to abandon the invasion of French territory. He then pressed into the Austrian Netherlands and defeated the enemy at Jemappes, on Nov. 6, 1792. This was the period of his highest power, and for the moment he was the greatest man in France. In 1793, after several small successes, Dumouriez was checked in his career of conquest by the Austrians under Prince Coburg in the battle of Neerwinden. Denounced at Paris as a traitor, he refused to appear before the bar of the Assembly to answer to the charges. After vainly trying to induce his army to embrace the cause of royalty, Dumouriez in despair deserted to the Austrians, with a few of his officers. The Convention set a price of 300,000 francs upon his head. After wandering through many countries of Europe, he finally settled in England, where he died in exile at Turville Park, near Henley-upon-Thames, March 14, 1823. Besides a multitude of pamphlets, Dumouriez wrote *Mémoires du général Dumouriez* (Hamburg, 1796) and *La vie et les mémoires du général Dumouriez* (3d ed., Paris, 1822-24). Consult: Welschinger, *Le roman de Dumouriez* (ib., 1890); Griffiths, *French Revolutionary Generals* (London, 1891); Chuquet, *La première invasion prussienne* (Paris, 1886); *Valmy* (1887); *La retraite de Brunswick* (1887); *Jemappes* (1890); *La trahison de Dumouriez* (1891); Rose and Broadley, *Dumouriez and the Defence of England Against Napoleon* (London, 1908).

**DUM PALM.** See DOOM.

**DUMPY LEVEL.** See ENGINEERING INSTRUMENTS.

**DUN.** See DON.

**DÜNA**, dü'nä, or SOUTHERN DVINA (in contradistinction to the Dvina of northern Russia). A river of West Russia, rising in a small lake in the southwestern part of the Government of Tver, 9 miles from the source of the Volga (Map: Russia, B 3). It flows in a semicircle at first southwest, and then northwest, finally forming the boundary between Courland and Livonia, and empties into the Gulf of Riga 10 miles below Riga. Its length is about 650 miles. The upper course of the river lies in a broken country, giving rise to numerous rapids. It is navi-

gable through almost its entire length. Ocean steamers can ascend only to Riga, but smaller vessels reach Düna. The traffic on the Düna is very considerable at high water, 2,000,000 tons being annually transported. Some of the tributaries are navigable. The Düna is connected by the Beresina Canal with the Dnieper, and is free of ice in its lower course for over 240 days in the year.

**DÜNABURG**, dü'nä-böörk (Russian official name since 1893, Dvinsk). A district town and fortress in the Russian Government of Vitebsk, situated on the Düna, 110 miles southeast of Riga, and 332 miles southwest of St. Petersburg (Map: Russia, C 3). It is a fortress of the first class and is situated at the junction of three important railway lines, to St. Petersburg, Warsaw, Libau, Riga, and Vitebsk. The chief manufacturing establishments are distilleries, tobacco and match factories, flour mills, brick works, tanneries, and limekilns. The commerce in flax and timber is considerable. Düna-burg was founded by the Livonian Knights in 1278, in 1561 became a part of Poland, and in 1772 was incorporated with Russia. Düna-burg was bombarded by the French in 1812 and was occupied by the allied Prussian and French forces under Macdonald in the same year. Pop. (main town), 1910, 89,884; (including suburbs), 110,912, of which over 30,000 are Jews.

**DUNA-FÖLDVÁR**, dü'nö-föld'vär (Hung., earth-walled fortress on the Danube, so called from its situation). A town of Hungary in the County of Tolna, on the right bank of the Danube, about 50 miles south of Budapest (Map: Hungary, F 3). It is in an agricultural region, and its trade by river includes fruit and wines. Pottery is made here, and there are sturgeon fisheries. Pop., 1900, 12,117; 1910, 12,087, mostly Magyars.

**DUNANT**, dü'nän', JEAN HENRI (1828-1910). A Swiss author and philanthropist, founder of the Red Cross Society (q.v.). He was born in Geneva and conceived the idea of founding a society for aiding wounded soldiers while visiting the scene of the battle of Solferino. He wrote *Un souvenir de Solferino* (1862; 5th ed., 1871; Eng. trans. by Mrs. D. H. Wright as *The Origin of the Red Cross*, 1911), and delivered lectures on the relief in war before the Society of Public Utility in Geneva. Soon afterward a meeting was held in that city which resulted in the Geneva Convention (1864) and the establishment of a permanent international committee. In 1864 the coöperation of 10 governments had been obtained, and the Red Cross Society was officially established (Aug. 22, 1864). M. Dunant bestowed his entire fortune on various charities. In 1901 he received the Nobel prize for service in the cause of peace. Besides the work already mentioned, he wrote the following: *Fraternité et charité internationales en temps de guerre* (1st to 7th ed., 1864); *L'Esclavage chez les musulmans et aux États-Unis de l'Amérique* (1863); *La rénovation de l'Orient* (1865).

**DUNBAR'** (Gael., Castle Point). A royal, parliamentary, and municipal burgh, and ancient seaport of Haddingtonshire, Scotland, on an eminence of the rocky coast near the mouth of the Firth of Forth, 20½ miles east-northeast of Edinburgh (Map: Scotland, F 4). There are two harbors, partly barred by reefs. Pop. (municipal burgh), 1901, 3581; 1911, 3346. The principal industries are the manufacture of

farming tools, distilling and brewing, and rope making. On the high rocks at the entrance to the new harbor are the ruins of a castle, built about the middle of the ninth century and, from the end of the eleventh century, the chief seat of the earls of March. It was once an important factor in resisting English invasion. Edward I. in 1296, after defeating the forces under Baliol, and Edward II fled thither after the battle of Bannockburn. It was successfully defended in a siege of six weeks against the Earl of Salisbury by Black Agnes, Countess of Dunbar, in 1339; it sheltered Queen Mary and Bothwell in 1567, and in the same year it was destroyed by the regent Murray. In September, 1650, Cromwell, at the "Race of Dunbar," defeated the Scottish army under Leslie.

**DUNBAR, PAUL LAURENCE** (1872-1906). An American poet of African race, born at Dayton, Ohio, and educated in the public schools of Dayton. He worked as a journalist in New York and on the staff of the Congressional Library. He appeared in public as a reader of his poems, which have been collected under the titles of *Oak and Ivy* (1893); *Majors and Minors* (1895); *Lyrics of Lowly Life* (1896); *Poems of Cabin and Field* (1899); *Lyrics of the Hearth Side* (1899); *Candle-Lightin' Time* (1902); *Lyrics of Love and Laughter* (1903); *Lil' Gal* (1904); *Lyrics of Sunshine and Shadow* (1905). His more mature work, when in dialect, deserves the generous commendation given it. He also wrote a volume of short stories, *Folks from Dixie* (1897); a novel, *The Uncalled* (1898); *The Sport of the Gods* (1902). Consult L. K. Wiggins, compiler, *Life and Works of Paul Laurence Dunbar* (1907); *Complete Poetical Works*, with W. D. Howells's introduction to "Lyrics of Lowly Life" (new impression, New York, 1913).

**DUNBAR, WILLIAM** (c.1465-1525?). The greatest of the old Scottish poets. Of his life very little is known, but he was born between 1460 and 1465, probably in East Lothian, and is supposed to be the William Dunbar who entered St. Andrews University in 1475 and graduated as M.A. in 1479. He cannot be traced at all during the next 21 years. From his poem, "Visitation of St. Francis," we learn, however, that he joined the Order of Franciscans and afterward left it. He says that as a begging friar he traveled from Berwick to Canterbury and crossed over to Picardy. By 1500 he was in the service of James IV of Scotland. In that year he was granted an annual pension of £10, afterward increased to £20 and then to £80. In 1501 he seems to have visited England in the train of the ambassadors sent thither to conclude the negotiations for the King's marriage to Margaret Tudor. Early in 1503, before the Queen's arrival, he composed, in honor of the event, an allegorical poem entitled "The Thistle and the Rose." He seems now to have lived chiefly about court, writing poems, and sustaining himself with hope of preferment in the church. After the ruinous defeat at Flodden, and the confusion consequent on the King's death and a prolonged regency, Dunbar's name disappears altogether. He probably died between 1520 and 1530. As a poet, he possessed a variety of gifts. He is at times as rich in fancy and color as Spenser in the *Faerie Queene*, as homely and shrewd and coarse as Chaucer in the *Miller's Tale*, as pious and devotional as Cowper in his *Hymns*, and as wildly grotesque in satire as

Burns in his *Death and Doctor Hornbook*. Besides the beautiful allegory cited above, Dunbar wrote another called "The Golden Targe." He is at his very best in the satires "The Two Married Women and the Widow" and "The Dance of the Deadly Sins." His *Works* were edited by Laing (2 vols., Edinburgh, 1834); also by Small and Mackay, for the Scottish Text Society (Edinburgh, 1884-93). Consult Schipper, *William Dunbar, sein Leben und seine Gedichte* (Berlin, 1884), and the *Cambridge History of English Literature*, vol. ii (New York and London, 1907-13).

**DUNBARTON** (Scotland). See DUMBARTON.

**DUNBIRD**, or **DUNKER**. See POCHARD.

**DUNCAN, ADAM**, first VISCOUNT DUNCAN OF CAMPERDOWN (1731-1804). A British admiral, born at Lundie, Forfar, Scotland. He was educated at Dundee, and entered the navy in 1746, became lieutenant in 1755, and fought against the French at Gorée, Africa. In 1761 he was promoted to be commander, served in the expedition against Belle Isle, and in the capture of Havana in the following year. He was engaged at the battle of Cape St. Vincent in 1780 and at the relief of Gibraltar two years later. He was promoted to be rear admiral of the blue in 1789 and became vice admiral in 1793. In 1795 Duncan was made commander in chief of the United English and Russian squadron in the North Sea and shortly afterward was appointed admiral. In the Nore Mutiny (1797) Duncan, who was a man of herculean proportions, 6 feet 4 inches in height, and strikingly handsome, quelled the disaffection on his vessel by displays of personal strength and the force of his personality. His strategical blockade of Texel with two ships was one of the most effective ever made, and on Oct. 11, 1797, near Camperdown, he destroyed the Dutch fleet on its way to invade Ireland and took Admiral De Winter prisoner. Ten days later he was created Baron of Lundie and Lord Viscount Duncan of Camperdown. While traveling to Edinburgh, he died suddenly at Cornhill Inn, near Coldstream. Consult: James, *Naval History of Great Britain* (London, 1822); Yonge, *History of the British Navy*, vol. i (ib., 1863); Earl of Camperdown, *Admiral Duncan* (ib., 1898).

**DUNCAN, ISADORA** (1880- ). An American dancer, born in San Francisco. She was for a time a dancing teacher in New York and attempted to revive classic, i.e., simple Greek, dances, but she was not warmly received. In Munich, Berlin, and Paris, however, where she later lived, she became very popular. At Grünwald, near Berlin, she established, under the immediate charge of her sister Elizabeth, a dancing school for girls from 4 to 14 years of age, where they receive free board and schooling. Miss Duncan was the first to popularize the barefoot dance in simple free draperies—the antithesis of ballet and toe dancing—and was particularly happy in her dances interpretative of Beethoven, Gluck, and Chopin. In 1913 she went into temporary retirement when the two children of her union with Gordon Craig (q.v.) were carried by a runaway motor car over the Seine embankment and drowned.

**DUNCAN, JAMES** (1857- ). An American granite cutter and labor leader, born in Kincardine Co., Scotland, whence he removed to the United States. He was secretary of the New York branch (1881) and of the Baltimore branch

(1884) of the Granite Cutters' International Association, of which he became national secretary-treasurer in 1895. He led a successful educational strike in the union and then (1900) the granite-cutting industry for an eight-hour day. He was vice president of the American Federation of Labor (1894), represented the American labor movement in the British Trades Council at Bristol, England (1898), and was a member of the Industrial Department of the Civic Federation (1901).

**DUNCAN, JOHN** (1796-1870). A Scottish theologian and Hebraist, born at Aberdeen and educated at Marischal College. He was ordained in 1836 and, after preaching in Milton Church, Glasgow, was sent to Pest, in 1840, as a missionary for the conversion of the Jews, and counted among his converts the celebrated Dr. Edersheim and the Rev. Dr. Adolph Saphir, afterward a minister of the English Presbyterian Church, London. After his return from Pest, in 1843, he was until his death professor of Oriental languages in New College, Edinburgh. Consult the *Life* (Aberdeen, 1872) by David Brown; the *Recollections of Duncan* by Stuart; and Knight's *Colloquia Peripatetica* (1870; 5th ed., 1879).

**DUNCAN, JOHN** (1805-49). An African traveler, born near New Brunswick. He entered the service at the age of 17 and served until 1842, in which year he went to Africa as a member of the Niger expedition and took a prominent part in negotiating treaties with the natives. The party subsequently was stricken with fever, and of the 300 men who had embarked in this expedition, only five, including Duncan, succeeded, after almost incredible hardships, in reaching England. In 1844 Duncan penetrated from the western coast to Whydah and subsequently passed through Dahomey to Adofidiah. In 1847 he published an interesting account of this expedition in the work entitled *Travels in Western Africa in 1845 and 1846*, and in the same year he contributed to Bentley's *Miscellany* a paper in two parts, entitled *Some Account of the Late Expedition to the Niger*. In 1849 he was appointed Vice Consul at Whydah.

**DUNCAN, LOUIS** (1862- ). An American electrical engineer, born in Washington, D. C. He graduated from the United States Naval Academy in 1880, but resigned from the navy in 1887; meanwhile he had taken advanced work at Johns Hopkins University, and in 1885 received a Ph.D. During the Spanish-American War he was major of the first volunteer engineers. He was associate in, and associate professor of, applied electricity at Johns Hopkins (1887-98), and head of the department of electrical engineering at Massachusetts Institute of Technology (1902-04). In 1895 he was president of the American Institute of Electrical Engineers. He is author of many articles on engineering topics in scientific journals.

**DUNCAN, NORMAN** (1871- ). An American author, brother of Robert Kennedy Duncan. He was born at Brantford, Ontario, Canada, and was educated at the University of Toronto. From 1897 to 1901 he was a member of the staff of the New York *Evening Post*, and in 1907-08 he was correspondent for *Harper's Magazine* in Asia Minor and Egypt. He was professor of rhetoric at Washington and Jefferson College (1902-06) and adjunct professor of

English literature at the University of Kansas (1908-10). *Doctor Luke of the Labrador* (1904) and his other stories of the Newfoundland coast life are sympathetic and skillful. His writings include: *The Soul of the Street* (1900); *The Way of the Sea* (1903); *Dr. Grenfell's Parish* (1905; 2d ed., 1911); *The Mother* (1905); *The Adventures of Billy Topsail* (1906); *The Cruise of the Shining Light* (1907); *Every Man for Himself* (1908); *Going Down from Jerusalem* (1909); *The Suitable Child* (1909); *Higgins* (1909); *Billy Topsail & Company* (1910); *The Measure of a Man* (1911); *The Best of a Bad Job* (1912); *Finding his Soul* (1913).

**DUNCAN, ROBERT KENNEDY** (1868-1914). An American chemist, brother of Norman Duncan. He was born at Brantford, Ontario, Canada. After graduating from the University of Toronto in 1892 he studied at Clark and Columbia universities; then he taught physics and chemistry in several secondary schools and was professor of chemistry at Clark and Jefferson College from 1901 to 1906. In the latter year he accepted the chair of industrial chemistry at the University of Kansas, in 1910 he became also director of industrial research, and he added to this work similar responsibilities at the University of Pittsburgh. He became visiting lecturer at Clark University in 1911. Besides contributing articles to popular and scientific magazines, he edited the *New Science Series* and wrote *The New Knowledge* (1905); *The Chemistry of Commerce* (1907); *Some Chemical Problems of Today* (1911).

**DUNCAN, SARAH JEANETTE**. See COTES, SARAH JEANETTE.

**DUNCAN, THOMAS** (1807-45). A Scottish portrait, historical, and genre painter, born at Kinclaven, Perthshire. Despite early indications of artistic talent, he was apprenticed by his father to a law writer. He studied painting in the Trustees' Academy, Edinburgh, under William Allen. His first pictures to attract wide attention were a "Scotch Milkmaid" and the "Death of Old Mortality," exhibited in London at the Royal Institution in 1829. In 1830 he was made a member of the Royal Scottish Academy, in which he became a professor, first of color, then of drawing. In 1840 he was made master of the Trustees' Academy, Edinburgh, and in 1843 an associate of the Royal Academy. He died in Edinburgh, on April 25, 1845. Duncan devoted himself chiefly to portraiture, but his best-known works are genre and historical pictures, taken from the history and life of the Scottish people. One of his most popular paintings is "Prince Charles and the Highlanders Entering Edinburgh," exhibited in London in 1840, into which he introduced the portraits of distinguished Scotchmen of the day. Two of his best-known genre pictures are the "Waefu' Heart," from the ballad of "Auld Robin Gray" (South Kensington Museum) and "Anne Page and Slender" (National Gallery of Scotland). The most interesting of his portraits is his own, exhibited in 1846, after his death. It was purchased by 50 Scottish artists and presented to the Royal Scottish Academy. Duncan's drawing was careful and graceful, and his paintings show some gift of color. Both as teacher and painter he exercised considerable influence over his immediate successors. Consult: Redgrave, *Dictionary of Artists of the English School* (London, 1878); Armstrong, *Scottish Painters*

(ib., 1888); Caw, *Scottish Painting* (Edinburgh, 1908).

**DUNCANSBY** (dūn'kanz-bī) **HEAD** (the Vervedrum of Ptolemy). A promontory 210 feet high, forming the northeast extremity of Caithness, Scotland, 1½ miles east of John o' Groat's House (Map: Scotland, F 1). It is noted for its extensive sea view, cliff scenery, and interesting geological phenomena.

**DUN'CIAD**, **THE** (from Eng. *Duns, dunse, dunce*, originally from *Duns man*, follower of John Duns Scotus, hence subtle reasoner, quibbler, ultraconservative, stupid man). A satirical poem by Alexander Pope (q.v.). It was published, in 1728, in three books; to these, in 1741, a fourth book was added, and for the original hero, Lewis Theobald, Pope substituted Colley Cibber.

**DUNCKER**, dūn'kēr, **MAXIMILIAN WOLFGANG** (1811-86). A German historian. He was born in Berlin and studied there and at Bonn, where he became involved in the democratic movements and was imprisoned. He became professor of history at Halle in 1842, a member of the German National Assembly in 1848, professor at Tübingen in 1857, was lecturer on politics to the Crown Prince of Prussia in 1861-66, and became director of the Prussian archives in 1867. His principal work is *Geschichte des Altertums* (5th ed., 1878-83, 7 vols., N. S. 1884-86, 2 vols.). Among his further publications are *Origines Germanicæ* (1840) and *Zur Geschichte der deutschen Reichsversammlung* (1849). Consult Haym, *Das Leben Max Duncckers* (1891).

**DUN'COMBE**, **THOMAS SLINGSBY** (1796-1861). An English politician. He studied at Harrow, served in the army in 1812-19, and was elected to Parliament from Hertford in 1826, lost this seat in 1832, and sat for Finsbury from 1834 until his death. He assisted in carrying the Reform Bill and became a prominent member of the extreme Liberal party. In 1842 he presented to Parliament the Chartist Petition. (See **CHARTISM**.) Sir James Graham, the Home Secretary, having sanctioned the opening of the letters of Mazzini, Duncombe vehemently denounced, in the House of Commons, the adoption of the post-office spy system on English soil. Consult *Life and Correspondence of Thomas Slingsby Duncombe* (London, 1868).

**DUNDALK**, dūn-dāk'. A municipal borough and seaport, the capital of the County of Louth, Ireland, beautifully situated at the mouth of the Castletown River, 54 miles north of Dublin (Map: Ireland, E 2). It is overlooked on the northeast by the Carlingford Mountains. Dundalk is the chief outlet for the produce of the counties of Louth, Monaghan, and Cavan, and is in daily steam communication with Liverpool. Besides large railway locomotive works, there are breweries, distilleries, tanneries, flax and jute spinning mills, and shipbuilding yards. The town has several educational institutions, including a public library, as well as an old parish church, and an imposing Roman Catholic chapel, modeled after King's College chapel of Cambridge. There are large cavalry barracks here. Pop., 1901, 13,076; 1911, 13,128. Edward Bruce took Dundalk in 1315 and made it the seat of his court until his death, in 1318, on the battlefield at Faughart. The city was captured by the Puritans under Cromwell in 1649 and by Schomberg in 1689.

**DUNDAS**. A town in Wentworth Co., On-

tario, Canada, 5 miles from Hamilton, on the Toronto, Hamilton, and Buffalo, and the Grand Trunk railroads (Map: Ontario, E 7). The Desjardins Canal connects it with Lake Ontario. The public park contains 25 acres. The manufacturing industries include tanneries, a builders' factory, a quarry, knitting factory, flour mill, and manufactured products include small tools, baskets, gloves, malt, clothing, doors, hosiery, machine tools, barber supplies, church and school furniture. Hydroelectric power is available. Pop., 1901, 3173; 1911, 4299.

**DUNDAS**, **HENRY**, first **VISCOUNT MELVILLE AND BARON DUNIRA** (1742-1811). A British statesman. The fourth son of Robert Dundas, Lord President of the Scottish Court of Session, he was born at Edinburgh, and received his education at the high school and university. He was called to the Scottish bar in 1763 and was successively appointed Deputy Advocate and Solicitor-General. In 1774 he was returned to Parliament for the county of Edinburgh, and in the following year was appointed Lord Advocate for Scotland. Two years after he was made Keeper of the King's Signet for Scotland. His successful career in Parliament was marked by ability rather than political consistency. In opposition to his constituents he allied himself with the party in power and became a strenuous supporter of Lord North's administration as one of the most obstinate and cynical defenders of the war with the American colonists. When Lord North resigned in 1782, Dundas continued to hold the office of Lord Advocate under the Rockingham ministry, and under the Shelburne ministry he became Treasurer of the Navy. In 1781-82 his investigation of Indian affairs originated the reform movement which led to the impeachment of Warren Hastings in 1786. He subsequently was the ablest coadjutor of Pitt, under whose ministry he became President of the Board of Control and principal Secretary of State for the Home Department (1791), where he displayed great harshness towards all Radical demonstrations in Great Britain and instigated the well-known and ridiculous treason trials of the year 1795. He also held a great number of other offices. When Pitt resigned in 1801, Dundas did the same. In 1802, under the administration of Addington, he was elevated to the peerage under the titles of Viscount Melville and Baron Dunira. In 1806 he was tried for "gross malversation and breach of duty" while acting as Treasurer of the Navy, but in spite of the splendid array of talent against him he was acquitted on all the charges. After this he took little part in public affairs, but spent most of his time in retirement in Scotland.

**DUNDAS**, **SIR JAMES WHITLEY DEANS** (1785-1862). An English admiral. He entered the navy in 1799 and in 1806 became commander. He was flag captain successively to Sir Thomas Parker and Sir Philip Dunham, and became rear admiral in 1841, and commander in the Mediterranean in 1852, when he became vice admiral. In the Crimean War he was chief naval commander and transported the army to the scene of action. His operations against Sebastopol were severely criticized, and in 1855 he was superseded by Sir Edward Lyon. Two years later he was promoted to the rank of admiral. He married his cousin Janet Dundas in 1808 and added her name to his own. He was made C.B. in 1839.



**DUNDAS**, SIR RICHARD SAUNDERS (1802-61). An English admiral, educated at Harrow and at the Royal Naval College. He commanded a vessel in the first war with China. In 1853 he was made a rear admiral and two years later, upon the resignation of Napier, was appointed commander in chief of the Baltic fleet which bombarded S. . . . 9-11, 1855) and blockaded the . . . . He became K.C.B. in 1856 and vice admiral in 1858.

**DUNDAS**, ROBERT, LORD ARNISTON (1685-1753). A Scottish jurist. He was admitted a member of the Faculty of Advocates at Edinburgh in 1709 and soon gained a reputation as an able lawyer. In 1717 he was appointed Solicitor-General, in 1720 became Lord Advocate, and in the next year Dean of the Faculty of Advocates. He was a member of Parliament from Midlothian from 1722 to 1737 and was an active opponent of Lord Hay's administration of Scottish affairs in 1734. In 1737 he became a judge of the Court of Session of Scotland and from 1748 until his death was Lord President of the court.—His son ROBERT (1713-87), also a jurist, was educated at Edinburgh University and studied Roman law at Utrecht and Paris. His career was remarkable in its similarity to that of his father. He was admitted to the Scottish bar in 1737, became an eloquent advocate, and in 1742 was appointed Solicitor-General, which office he resigned in 1748 upon becoming dean of the Faculty of Advocates. He was appointed Lord Advocate in 1754 and was elected to Parliament from his father's old constituency in Midlothian in the same year. In 1760 he succeeded Robert Craigie as Lord President of the Court of Session and took the office just seven years after it had been left vacant by the death of his father. He retained the position until his death. Consult Omond, *Lord Advocates of Scotland* (Edinburgh, 1883), and *The Arniston Memoirs* (ib., 1887).

**DUNDAS STRAIT**. A passage separating Melville Island from Coburg Peninsula (q.v.), northern Australia (Map: South Australia, Northern Territory, C 1). It is 18 miles in width.

**DUNDEE** (Gael. *Dun Taw*, fort on the Tay). A royal, parliamentary, and municipal burgh and seaport, in Forfarshire, Scotland, on the left bank of the Firth of Tay, the estuary of the river Tay, 10 miles from the sea, and 59 miles by rail north-northeast of Edinburgh (Map: Scotland, F 3). The greater part of it is situated on a slope; there is a water frontage of 4 miles. A handsome esplanade skirts the estuary for 2½ miles. The new streets are wide and well laid out. The most striking architectural features are the town hall (1734), in the Roman Ionic style, with a spire 140 feet high; the Albert Institute, including a free library, picture galleries, museum, and several halls, in fifteenth-century Gothic; the royal exchange (1853-56) in the Flemish Pointed style of the fifteenth century; the corn exchange, the infirmary, the justiciary and sheriff-court buildings, the post office, the Town Churches (three under one roof), with the old tower, 156 feet high, restored in 1873; St. Paul's Episcopal Church, in Decorated Gothic, with a tower and spire 211 feet high; a new orphan asylum; University College, opened in 1893 and affiliated with St. Andrews University; Kin-naird Hall (for public meetings), and the Technical Institute (opened in 1888). Dundee

sends two members to Parliament. In 1889 it was raised to the rank of a city. It owns its water, gas, and electric supplies, which net it a substantial profit; maintains cemeteries, markets, . . . . and public baths. The street . . . . owned and operated by the municipality. Dundee has several public parks, one of which, the Baxter Park, on a beautiful slope to the eastward of the town, is 37 acres in extent; another, to the westward of the town, occupies the hill of Balgay and is finely wooded and beautifully laid out, its area being about 36 acres; adjacent to it is Lochee Park, of 25 acres. There are several smaller parks.

Dundee is the chief seat in Great Britain of the manufacture of coarse linen fabrics (osnaburges, sheetings, ducks, dowlas, drills, canvas, and cordage). Of still greater importance is the jute manufacture; many varieties of fabric are made, from the coarsest nail bagging to carpets of great beauty. The jute, flax, and hemp manufactures employ some 50,000 hands. Some of the mills are among the finest in the world. Dundee is also famous for its manufactures of confectionery and marmalade. It is the seat of the formerly important whale and seal fishing industry. Shipbuilding (both wood and iron) and machine making are carried on to some extent. Dundee has splendid harbors in addition to the tide harbor, several large wet docks, two graving docks, and a jetty for vessels drawing more than 24 feet of water. Shipping entered and cleared, in 1912, 354,554 tons. The number of vessels belonging to the port has declined in recent years. The exports include the textiles mentioned above and machinery, millwork, and spirits. The imports include wheat, flour, flax, jute, hemp, timber, sugar, paper-making materials, oilseed cake, mineral ores, etc. Dundee's products are shipped principally by rail; in 1912 the imports amounted to £7,011,286, while the exports were £1,623,632. Dundee became in 1912 the second port in importance in Scotland. It is the seat of a United States consul. At the entrance of the Firth, one of the largest iron bridges ever constructed has been built across the Tay. It was opened in 1887 and is more than 2 miles long. In 1901 the population was 161,173. In 1914 the burgh of Broughty Ferry was annexed to Dundee, increasing the latter's area to 5964 acres and its population, according to the 1911 census, to 176,062. In population Dundee is the third city in Scotland. Dundee was made a royal burgh by William the Lion about 1200. Its strong fortifications made it of the highest military importance, and in the wars between the Scotch and the English it was taken repeatedly by both parties. It was partially destroyed by John of Gaunt in 1385 and was pillaged by Montrose in 1645. In 1651 General Monk sacked and burned the town and massacred 1000 of its inhabitants. From the important part it played in the Reformation, Dundee gained the name of the "Scottish Geneva." Consult Thomson, *History of Dundee* (Dundee, 1874), and Peterson, *Saint Andrews and Dundee* (ib., 1893).

**DUNDEE**, VISCOUNT. See GRAHAM, JOHN, VISCOUNT DUNDEE.

**DUNDERBERG**. See DONDERBERG.

**DUNDONALD**, EARL. See COCHRANE, THOMAS.

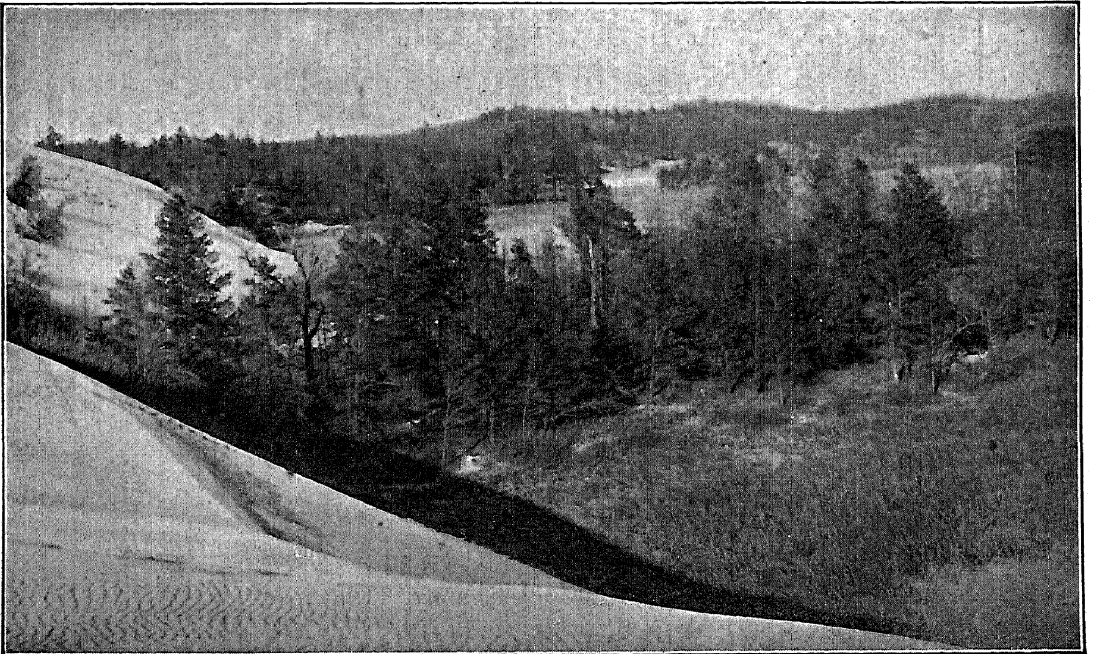
**DUNDREARY**, LORD. An amusing caricature of the English nobility, in *Tom Taw*.



## DUNES



AN EMBRYONIC SAND DUNE, developing on a beach at Chicago, Ill. The grass which acts as a sand-binder is the Sand Reed (*Ammophila*).



A LIVING SAND DUNE, at Dune Park, Ind., advancing over swamps and forests, destroying almost everything in its path.



lor's *Our American Cousin*. Originally a minor part, it was gradually developed by E. A. Sothern until it became the most prominent character in the play.

**DUNDRUM BAY.** An inlet on the east coast of Ireland, in County Down, 5 miles to the south of Downpatrick. It is about 10 miles wide at its entrance (Map: Ireland, F 2). In the inner bay is the famous strand of the champions where ancient Ultonians achieved athletic preëminence.

**DUNE** (AS., OHG. *dūn*, Ger. *Düne*, Fr. *dune*, from Ir. *dūn*, hill, fort, Welsh, *din*, Gall. *dūnon*; ultimately connected with AS., Icel. *tūn*, Eng. town, OHG. *zūn*, Ger. *Zaun*, hedge). The name first given to the sand hills or mounds which stretch along the seacoast of the Netherlands and the north of France. The English term Downs (q.v.) has a similar meaning. Drift sand hills or dunes are found in all regions of sandy, arid soil which are subject to brisk and high winds. Along the sandy Atlantic coast of North America, from Cape Cod to Cape Canaveral and beyond, such wind-built hills of moving sands are common features. In this region they are found from 5 to 40 feet in height, while on the coasts of the Bermudas or Bahamas they reach a height of 100 to 200 feet. They also characterize portions of the shores of Lake Michigan, the Caspian Sea, Sea of Aral, and other inland water bodies.

Concerning the growth of the dunes of the Netherlands, W. Chambers's *Tour in Holland* says: "At low water, when the beach is exposed to the action of the winds from the German Ocean, clouds of sand are raised into the air and showered down upon the country for at least a mile inland; and, this constantly going on, the result is, that along the whole line, from Haarlem to about Dunkirk or Calais, the coast consists of sandy mounds of great breadth, partially covered with grass and heath, but unfit for pasturage or any other purpose, and these are the bulwarks which protect the coast. In some places these dunes look like a series of irregular hills; and when seen from the tops of the steeples, they are so huge as to shut out the view of the sea." See DESERT; ÆOLIAN ACCUMULATIONS.

**DUNEDIN**, *dūn-ē'din*. The capital and chief port of the Province of Otago, South Island (Map: New Zealand, S. I., C 6). It is a thoroughly modern city built among steep hills, overlooking an excellent harbor on the east shore of the island. Encircling the city is a forest preserve called the Town Belt, and around it many beautiful suburbs. There are numerous handsome buildings, including churches, the post office, hospital, town hall, athenæum and museum, mechanics' institute, and several libraries. Dunedin is the seat of Otago University, opened in 1871, has faculties of arts, medicine, chemistry, and mineralogy; also of a training college for teachers. The United States has a resident consular agent. The city is the see of an Anglican and a Roman Catholic bishop. It is in regular steam communication with Melbourne and is connected by rail with the principal cities on the island. The principal articles of export are grain, potatoes, and wool, and cold-storage meat. Woolen goods are the most important articles of trade and manufacture. Much gold is mined near by. From its foundation by an association of members of the Free church of Scotland in 1848, the city rapidly

increased in importance, chiefly after the year 1861, when the discovery of extensive gold fields in the district caused a sudden increase of population. 1911, 64,237.

**DUNE VEGETATION.** Plants which inhabit sandy areas that are or have been worked over by the wind. Although commonly regarded as composed of xerophytes only, they are found to include mesophytes upon dunes that have been established for centuries. The pioneer conditions upon dunes are very severe, not so much on account of the absence of water, as because of the instability of the sand. Upon such moving areas not only are the plants pronounced xerophytes, but the most successful species are those that are able to withstand submergence and to multiply by means of underground stems which root at frequent intervals and so extend over irregularly wide areas. Probably the most characteristic beach-dune plant is the sand-reed or Marram grass (*Ammophila* or *Psamma*), found throughout the Northern Hemisphere, and often planted to aid in holding dunes. Equally successful among woody plants are various species of small willows, while shrubby cherries and sumachs are abundant in many parts of the United States.

The most interesting of all dunes are the wandering dunes, since they present peculiar ecological conditions. As a dune moves over a region, it often submerges the vegetation on its pathway, whether it be lowland or upland. Very few plants can adapt themselves to the new conditions, though a few species, especially willows, are able to do so. As a dune passes on, the buried plant societies often appear again as soil lines, and sometimes dead trees are shown—a sort of natural graveyard.

On the moving sand the vegetation is very scanty, in spite of the fact that there is a very constant although rather small water supply a few inches below the surface. The vegetation consists of antecedent plants, such as the willows, poplars, and a few other trees and shrubs that by sending out roots from the buried stems surmount the advancing sand, together with grasses and other subsequent plants that are able to germinate upon the surface of the dune. Among the antecedent trees that are able to survive are some surprisingly mesophytic species, like the linden. If a dune for any reason ceases its movement, vegetation easily finds a foothold, and either the grasses multiply and form a continuous turf, or more commonly a forest, in which pines and small oaks are often prominent, becomes established. Once fixed and covered with plants, the dune vegetation in temperate climates rapidly advances in richness and luxuriance. These facts show that it is the instability of dunes, rather than their xerophytic character, which excludes plant life. In tropical regions, the dune plants, of course, belong to quite different species, yet their ecological characteristics are the same. There, as in the United States, xerophytic grasses, with long underground stems which have the power to flourish when half buried in the sand, are still the dominating forms. Dunes that have remained fixed for many centuries may be again started into motion by the destruction of their vegetation. This is usually brought about through the agency of man, either by means of the removal of the forest by cutting the trees too closely or by forest fires, or, where there are no trees, by pasturing too closely. In New

Zealand sheep pastured upon the grass-covered dunes during dry seasons strip the turf so completely that the wind is able to start the sand beneath into motion, forming ever-increasing dunes that rapidly submerge valuable pasture lands. The remedy consists of planting the windward slope with a grass, such as the Maram grass, mingled with some shrub, like one of the willows, and when movement has ceased, planting trees. Experience in Belgium and other European countries shows that only forested dunes can be relied upon to remain in place and not cause damage by submerging agricultural lands.

**Bibliography.** Cowles, *Ecological Relations of the Vegetation of the Sand Dunes of Lake Michigan* (Chicago, 1899); Massart, *Essai de géographie botanique des districts littoraux et alluviaux de la Belgique* (Brussels, 1908); Cockayne, *Report on the Sand Dune Area of New Zealand* (Wellington, N. Z., 1911). See EDAPHIC; XEROPHYTES; DESERT.

**DUNFERMLINE**, dūn-fēr'lin (Gael., fort of the alder-tree pool). A royal burgh and city, and the chief town of the western district of Fifeshire, Scotland, situated on high ground 3 miles from the Firth of Forth, 16 miles northwest of Edinburgh (Map: Scotland, E 3). It was a place of note before the end of the eleventh century, and some interesting fragments of its ancient regal and ecclesiastical magnificence remain. What is called Malcolm Canmore's tower is a mass of shapeless ruins, but the south wall of the palace of the Stuarts exists, overhanging the romantic glen of Pittencrief. Of the abbey, the frater hall or refectory and a tower and arched gateway remain. Queen Margaret was married to Malcolm Canmore here in 1070 and influenced the founding (1075) of a Benedictine priory, afterward made an abbey, where now rest the dust of some of Scotland's most illustrious dead, notably Queen Margaret and Canmore, Alexander I and his Queen, David I, Malcolm IV, and Robert Bruce and his Queen. Among the noteworthy buildings are the Carnegie library, Carnegie baths, St. Margaret's Hall, the Abbey Church, high school, county and corporation buildings. The staple trade of the town is damask-linen weaving, which took its rise about the beginning of the eighteenth century. There are establishments for the spinning of linen yarn, and several large factories where steam and hand loom weaving is carried on. There are also large collieries and lime-works, iron foundries, breweries, dyeworks, and fire-clay works. Pop. (municipal burgh), 1901, 25,250; 1911, 28,103. The palace, of which but few vestiges remain, was frequently visited by the court, while the abbey became the burial place of the Scottish kings. Charles I was born in the palace in 1600. Dunfermline was made a royal burgh in 1588. In the seventeenth century the town was burned by the soldiers of Cromwell. The modern history of Dunfermline is chiefly remarkable in connection with the rise of Scottish dissent: Ralph Erskine, brother of Ebenezer (q.v.), and one of those who joined the latter in the secession movement in 1737, was assistant minister there; and 15 years later the resistance of the presbytery of Dunfermline to the attempt to force a minister upon a congregation led to the formation of the Relief Church. (See PRESBYTERIANISM.) Consult Chalmers, *Historical Account of Dunfermline* (Edinburgh, 1844-59).

**DUNFORD, PORT.** See PORT DUNFORD.

**DUNGARVAN.** A municipal borough, seaport, and bathing place in Waterford Co., Ireland, 28½ miles west-southwest of Waterford (Map: Ireland, D 4). Brewing and the manufacture of woollens are the important industries. The fisheries are also productive, and the town has an export trade in grain, butter, and cattle. Dungarvan has the remains of an Augustinian abbey founded in the seventh century by St. Garvan. Pop., 1901, 4850; 1911, 4977.

**DUNG BEETLE.** A name given to various beetles of the family Scarabidae, belonging chiefly to the genera *Canthon*, *Copris*, *Phanæus*, *Aphodius*, *Geotrupes*, and *Trox*. All these beetles breed in dung, either in situ, or which they have transported in pellets or balls to burrows in the ground. Thus they are useful as scatterers and disposers of offensive matter. Some forms carry their scavenging propensities still further and feed on decaying animal matter and on fungi. The American tumblebugs belong to the first three genera enumerated, and are the forms most familiar to us, because they are so frequently seen rolling their pellets along roadways and in pastures. Both sexes unite in the labor of rolling the balls, within which the eggs are laid. *Canthon levis* is a dull, blackish-brown beetle, the commonest species of its genus. *Phanæus carnifex* of eastern North America has a copper-colored thorax and green elytra; the head of the male is horned. *Copris carolina* is a black horned species, occurring along the Atlantic slope as far north as Massachusetts. The genus *Aphodius* has more than 100 species in America, frequenting the dung of cattle and horses in pastures. The adults are on the wing during warm days of autumn. The most common species is *Aphodius fimetarius*, with red wing covers. *Geotrupes* digs breeding holes in the earth, into which the female rolls chunks of the dung as food for the young. The skin-beetle genus, *Trox*, feeds on decaying animal hoofs and hair. Dung beetles have long attracted the attention of man. The Egyptians contemplated them with veneration, placed them in the tombs together with their dead, sculptured and painted them on their sarcophagi, and made imitations of them of various materials, often of precious stones. The ball of dung the Egyptians supposed represented the earth, and the beetles the sun; moreover, they were thought to be a race of males, and hence were the symbol of warriors. This last superstition was carried to Rome. See SCARABÆIDÆ and illustrations on Plate of BEETLES. Consult Ward, "A Popular Treatise on Egyptian Scarabs," in *Art and History* (London, 1901); also Budge, Petrie, and Wallis.

**DUNGENESS.** A headland forming the southern extremity of Kent, England, 10 miles southeast of Rye, inclosing the Romney Marshes (Map: England, H 6). It has a fort and a lighthouse.

**DUNGEON.** See DONJON.

**DUNGLISON, ROBLEY** (1798-1869). An American physician. He was born at Keswick, England, was educated in Germany, and in 1824 was called to the chair of medicine in the University of Virginia. From 1833 to 1836 he was professor in the University of Maryland, and from 1836 to 1868 in the Jefferson Medical College in Philadelphia. He was a diligent student, and was the author of a large number of excellent medical books, among which are:

*Human Physiology* (1832; 5th ed., 1844); *Medical Dictionary* (1833; 23d ed., 1903); and *General Therapeutics and Materia Medica* (1836; 6th ed., 1857). Consult *Memoir of Dr. Robley Dunglison*, by his son, Dr. R. J. Dunglison (Philadelphia, 1870).

**DUNITE** (named from *Dun*, the Scotch for "hill"). A rock composed almost entirely of olivine. See PERIDOTITE.

**DUNKARDS, or DUNKERS.** See CHURCH, OF THE BRETHREN.

**DUNKER, dŭn'kēr, WILHELM** (1809-85). A German mineralogist. He was born at Eschwege, Hesse, and was educated at Göttingen. He was professor of mineralogy and geognosy from 1854 until his death. In

Hermann von Meyer he founded (1846) the scientific periodical entitled *Paleontographica, Beiträge zur Naturgeschichte der Vorwelt*, of which thirty volumes had been published up to 1883. His principal works comprise the following: *Beiträge zur Kenntniss des norddeutschen Oolithengebildes und dessen Versteinerungen* (with Friedrich Koch, 1837); *Monographie der norddeutschen Wälder* (1846); *Index Molluscorum Guineensis* (1853); *Mollusca Japonica* (1861); *Index Molluscorum Maris Japonici* (1882).

**DUNKIN, CHRISTOPHER** (1811-80). A Canadian statesman. He was born in England, and was educated at London and Glasgow Universities. In early manhood he came to the United States and in 1834 was appointed an instructor in Greek at Harvard University. The following year he removed to Montreal, and in 1837-38 he edited the *Morning Chronicle* of that city. When Upper and Lower Canada were united by the Act of 1841 Dunkin was made Assistant Provincial Secretary, an office which he held until 1847. In the meantime he studied law, was called to the bar of Lower Canada in 1846, and soon had a large practice in Montreal. His reputation was greatly increased in 1853 when he argued before the Legislative Assembly against a proposed measure for reducing alleged exorbitant rents of the seigniors of Lower Canada. In 1857-61 and 1862-68 he was a Conservative member of the Legislative Assembly. In 1864 he procured the passage of the "Dunkin Act" to restrict the liquor traffic by local popular control. He opposed confederation and during the parliamentary session of 1865 was the ablest of the speakers in opposition to that change. In 1867 he was made provincial treasurer of Quebec. In 1869 he was again elected to the Dominion Parliament, and became Minister of Agriculture in the first administration of Sir John Macdonald after confederation. In 1871 he resigned that position and was appointed a puisne judge of the Superior Court of Quebec.

**DUNKIRK, dŭn'kĕrk** (Celt., church on the dunes), *Fr.* DUNKERQUE, dŭn'kĕrk'. A fortified seaport of France, capital of an arrondissement in the Department of Nord, on the Strait of Dover, 155 miles north of Paris, and 28 miles northeast of Calais (Map: France, N., H 1). The town is connected by railway and canal with the principal manufacturing centres of Belgium and France. It is surrounded by ramparts, and ditches, and forms part of an extensive system of fortifications, which includes Calais and Gravelines. The harbor, which is approached by a natural roadstead, is accessible to the largest vessels. There are four dry docks,

and the quays are over five miles in length. The town is well built, the streets spacious and well paved, the houses chiefly of brick. The principal streets converge at the Place Jean Bart, in the centre of which is a statue of Jean Bart by David d'Angers. Near by is a belfry (290 feet) containing a fine chime of bells. It was once the western tower of Saint-Eloi, but is now separated from that church by a street. Saint-Eloi is a Gothic structure of the sixteenth century, having a handsome though rather incongruous frontispiece in its more recent Corinthian portico. Other architectural features are the chamber of commerce, the fine modern town hall, and the college and theatre. Dunkirk has a fine museum, picture gallery, and public library. There are manufactories of soap, starch, beer, beet sugar, cordage, and leather; also metal foundries, distilleries, and shipbuilding yards. Dunkirk ranks third among the seaports of France (fourth among the ports, counting Paris). The value of its imports and exports combined in 1911 was 1,042,900,000 francs. Its cod and herring fisheries are actively prosecuted. The United States is represented by a consular agent. The immediate vicinity of Dunkirk has a dreary appearance. Pop. (commune), 1911, 38,891. In 1851 Dunkirk had 29,080 inhabitants.

Dunkirk owes its origin, it is said, to the church built by Saint-Eloi in the seventh century in the midst of a waste of sand hills or dunes, and hence its name, "Church on the Dunes." It shared the fortunes of Flanders, coming successively under Burgundian, Austrian, and Spanish rule. It was burned by the English in 1388. It was taken from the Spaniards by the French (under Turenne) in 1658 and made over to England, but was sold to Louis XIV by Charles II in 1662. By the Treaty of Utrecht in 1713 the French were compelled to destroy the fortifications of Dunkirk, which were again restored, however, in 1783. Consult Derode, *Histoire de Dunkerque* (Lille, 1852), and Saint-Leger, *La Flandre maritime et Dunkerque* (Paris, 1900).

**DUNKIRK.** A city in Jay Co., Ind., 30 miles east of Marion, on the Pennsylvania Railroad (Map: Indiana, D 2). It is in the gas belt and has large glass factories. It is governed, under a charter of 1893, by a mayor, elected quadrennially, and a council. It owns its water works. Pop., 1900, 3187; 1910, 3031.

**DUNKIRK.** A city and port of entry in Chautauqua Co., N. Y., 41 miles southwest of Buffalo; on Lake Erie, and on the Lake Shore and Michigan Southern, the Pennsylvania, the Erie, the New York, Chicago and St. Louis, and the Dunkirk, Allegheny Valley and Pittsburgh railroads (Map: New York, A 6). It has a good harbor, protected by a breakwater, and a large lake trade. The industrial plants include locomotive works, axe and steel factories, radiator and gas-engine works, planing mills, shirt factories, etc. Among the features of interest are the high-school building, public library, Brooks Memorial Hospital, Gratiot Park, and Washington Park. Dunkirk was settled about 1809, was incorporated as a village in 1837, and was chartered as a city in 1880. It is governed, under a revised charter of 1909, by a mayor, elected biennially, who controls the appointments to the civil service commission, and board of health; and by a common council

of five members, elected by the voters of the city at large. The board of education is elected by the people. The water works and electric-light and power plants are owned by the municipality. Pop., 1890, 9416; 1900, 11,616; 1910, 17,221; 1914 (U. S. est.), 19,607.

**DUNLAP, WILLIAM** (1766-1839). An American artist and author. He was born at Perth Amboy, N. J. In 1784 he went to London and for several years studied painting with Benjamin West. On his return to America he engaged chiefly in dramatic and literary work, producing *The Father*, his best play, in 1789, and becoming manager of the Park Theatre, New York, in 1798, where *André* was played the same year. His administration, which contributed much to the development of dramatic art, was continued for several years, but finally resulted in theatrical bankruptcy. Many of his plays have never been published. Later to art, he gained reputation in the country by religious paintings, of which "Death on the Pale Horse" is most famous. He was one of the founders and an early vice president of the National Academy of Design. The most noteworthy of his publications is his *History of the American Theatre* (1832). He also wrote biographies of *George Frederick Cooke* (1813) and *Charles Brockden Brown* (1815); *History of the Rise and Progress of the Art of Design in the United States* (1834); and *Thirty Years Ago: or, the Memoirs of a Water Drinker* (1836). The Dunlap Society, founded in 1886, has reprinted *The Father* and *André*. Consult A. Marble, *Heralds of American Literature* (1907).

**DUNLIN** (a corruption of *dunling*, from *dun*, in reference to the color + diminutive *-ling*), or **REDBACK**. A sandpiper of the Northern Hemisphere, which migrates annually between arctic breeding grounds and the tropics, and is an object of eager sport in the late spring, when it appears in large compact flocks not very difficult to approach. The plumage changes greatly with the season, in winter being prevailing gray, while in summer the back is chestnut-red, each feather with a black centre, a broad white band covers the dusky wing, and a broad jet-black band marks the abdomen, while the white breast and throat are thickly streaked. It breeds in Europe from Scotland northward, in Kamchatka, in Alaska, and eastward to Greenland. The European bird is systematically named *Pelidna* or *Erolia alpina alpina*, and is known in Great Britain as *dunlin*, *purre*, *oxeye*, etc. The American and Siberian examples are separated in a subspecies, *alpina sakhalina*, locally known to gunners as *blackheart*, *ox-bird*, *oxeye*, *redback*, etc.

**DUNLOP, JOHN COLIN** (c.1785-1842). A Scottish critic and author, born at Rosebank, near Glasgow. He passed most of his life in study, read widely in Greek, Latin, Italian, Spanish, and French, and embodied his knowledge in various histories, of which only *The History of Prose Fiction* (1814; revised 1816) is important. This work, though very uneven in quality, has never been superseded. At least at the time of its appearance the sections dealing with Italian and Spanish fiction were found especially valuable. It was translated into German in 1851, and revised in 1888 (London and New York).

**DUNMORE**. A borough in Lackawanna Co., Pa., adjoining Scranton, on the Erie and

the Lackawanna railroads (Map: Pennsylvania, K 3). It contains St. Mary's Academy, St. Joseph's Infant Home, and homes for the aged and friendless. The borough is the centre of extensive anthracite coal, brick, stone, and silk interests. Under a charter of 1862, the government is vested in a burgess, elected every four years, a council, and administrative officials, of whom are chosen by popular vote. Dunmore was settled in 1835 and incorporated in 1862. Pop., 1890, 8315; 1900, 12,583; 1910, 17,615; 1914 (U. S. est.), 19,757.

**DUNMORE, JOHN MURRAY, EARL OF** (1732-1809). An English Governor of Virginia. He sat in the House of Lords in 1761-69 as a representative peer of Scotland; in 1770 was appointed Governor of the Colony of New York, and in 1771 of that of Virginia. He dissolved the House of Assembly in 1772, 1773, and 1774—on the last occasion because of the resolution of that body to observe June 1, the day for the closing of the port of Boston, as a time of public fast. He commanded a division of Virginia troops in Dunmore's War (q.v.), upon the conclusion of which he made an important treaty with the Indians. In April, 1775, he removed a part of the powder stores from Williamsburg to the warship *Magdalen*. Thereupon the colonists in large numbers volunteered for military service under the direction of Patrick Henry. During a session of the House, in June, a riot occurred, and Dunmore transferred the seat of government to the man-of-war *Fowey*, 12 miles off Yorktown. The burgesses finally declared that the Governor had abdicated, and vested a committee of safety with executive powers. Dunmore equipped a flotilla, with which he unsuccessfully attacked Hampton on October 25. He burned Norfolk on Jan. 1, 1776. On July 8 he was forced by Andrew Lewis (q.v.) from the station which he had taken on Gwynn's Island, in the Chesapeake, and shortly afterward, having burned the smaller vessels and sent the remainder to the West Indies, returned to England, where he sat in the House of Lords until 1787. From 1787 to 1796 he was Governor of the Bahamas. Consult Campbell, *History of Virginia* (1860).

**DUNMORE'S WAR**. A war in 1774 between the Indians and the whites on the western frontiers of Virginia, so called from Lord Dunmore, then Governor of Virginia, who was accused, apparently with little justice, of having caused it in order to prevent the Virginians from taking part in the approaching war with England. The murder of the family of Logan, a noted Mingo chief (see LOGAN, JOHN), on April 30, 1774, by a man named Greathouse and his associates, was the occasion for the outbreak of general hostilities, and for several months thereafter there were frequent Indian attacks of unusual ferocity. The Virginian government promptly raised a force of about 3000, and in September, General Lewis (see LEWIS, ANDREW), with about 1200 men, marched to the mouth of the Great Kanawha, there to await a second force of about 1300 under Lord Dunmore, who was to start from Fort Pitt. Dunmore subsequently changed his plans, however, and on October 10 Lewis fought alone the important battle of Point Pleasant, which virtually closed the war. (See POINT PLEASANT, BATTLE OF.) Soon afterward Dunmore made a treaty with the Indians, whereby the latter



agreed not to hunt south of the Ohio and not to molest voyagers on the river. But for this war, it is likely that the migration of settlers to the West would have been almost wholly checked until after the close of the Revolution, and that, in consequence, the western boundary of the United States might have been fixed by the Treaty of 1783, at the Alleghany Mountains. The war is sometimes called "Cresap's War," from Captain Michael Cresap, who was unjustly charged with having murdered Logan's family. Consult Roosevelt, *Winning of the West* (vol. i, New York, 1889), and Perkins, *Annals of the West* (Pittsburgh, 1857).

**DUNMOW** (dūn'mō) **FLITCH OF BACON.** A prize instituted at Dunmow, in Essex, England, in 1244, by Robert de Fitzwalter, on the following conditions: "That whatever married couple will go to the priory, and, kneeling on two sharp-pointed stones, will swear that they have not quarreled nor repented of their marriage within a year and a day after its celebration, shall receive a flitch of bacon." The prize was first claimed in 1445, two hundred years after it had been instituted. Only five presentations were made up to 1751, and the flitch was not again claimed till 1855. From 1860 to 1891 there were seven awards. More awards have been made since then. Consult Andrews, *History of the Dunmow Flitch* (London, 1887).

**DUNN, GANO** (1870- ). An American electrical engineer, born in New York City. He graduated from the College of the City of New York in 1889 and from the engineering department of Columbia in 1891. He was in the service of the Western Union Telegraph Company from 1886 to 1891 and then of the Crocker-Wheeler Company, of which he was vice president and chief engineer from 1898 to 1911; and in 1911 he became vice president and head of the electrical and construction work of J. G. White & Co., New York. He was president of the New York Electrical Society (1900-02), vice president (1901-03, and 1905-07) and president (1911-14) of the American Institute of Electrical Engineers, and vice president of the International Electrical Congress at Turin (1911). In 1914 he received an honorary M.S. from Columbia University. He is author of various papers on electrical subjects.

**DUNN, SAMUEL ORACE** (1877- ). An American transportation specialist, born at Bloomfield, Iowa. He learned the printing trade after graduating from high school, was editor of the *Quitman (Mo.) Record* (1895-96) and associate editor of the *Maryville (Mo.) Tribune* (1896-1900); from 1900 to 1904 was reporter, and later editorial writer, on the *Kansas City Journal*, and in 1904-07 was connected with the *Chicago Tribune* as railroad editor and editorial writer. In 1907-08 he was managing editor of the *Railway Age*, and thereafter editor of the *Railway Age Gazette*. He is author of *The American Transportation Question* (1912) and *Government Ownership of Railways* (1913).

**DUNNE, EDWARD FITZSIMONS** (1853- ). An American lawyer and political leader, born at Waterville, Conn. He spent three years at Trinity College, Dublin, and graduated from the Union College of Law and was admitted to the bar in 1877. He was circuit court judge of Cook Co., Ill., from 1892 to 1905, when he was elected mayor of Chicago. He became well known for his advocacy of a municipal-ownership

policy and was chosen the vice president of the National Civic Federation. In 1907 he returned to the practice of law. He was presidential elector in 1900 and delegate at large to the Democratic National Convention in 1908. He was elected Governor of Illinois for a four-year term in 1913, defeating Charles S. Deneen.

**DUNNE, FINLEY PETER** (1867- ). An American humorist. He was born in Chicago, Ill., and, having obtained a common-school education there, served from 1885 to 1891 as a reporter on various newspapers. From 1891 he was editorially connected with the Chicago newspaper press as successively city editor of the *Times* (1891-92), member of the *Evening Post* and *Times-Herald* staffs (1892-97), and editor in chief of the *Evening Journal* (1897-1900). He first attracted attention by the publication in the *Times-Herald* of a series of sketches in which, through the medium of one Martin Dooley, publican of Archey Road, he passed humorous comment upon a variety of subjects. With the Spanish-American War he more prominently developed a vein of political and social satire, and upon the publication of *Mr. Dooley in Peace and in War* (1898), a volume of selections, attained wide popularity in America and England. *Mr. Dooley in the Hearts of his Countrymen* (1898), *Mr. Dooley's Philosophy* (1900), *Mr. Dooley's Opinions* (1901), *Observations by Mr. Dooley* (1902), and *Mr. Dooley Says* (1910) appeared in continuation. In his shrewd analysis of fault and foible, his ability to "speak truth smiling," and speak it with a certain distinctive gusto, "Mr. Dooley" occupies the leading place among latter-day American humorists.

**DUNNET HEAD.** The northernmost point of the mainland of Great Britain in Caithness, Scotland, guarding the western entrance to the Pentland Firth (between Scotland, E 1). It is 280 feet high, is crowned with a lighthouse, 67 feet in height, visible 24 miles, and is the ancient Tarvedrum, or Oreus Promontorium.

**DUNNING, ALBERT ELIJAH** (1844- ). An American Congregationalist clergyman, born at Brookfield, Conn. He graduated from Yale University (1867) and at Andover Theological Seminary (1870). After holding the pastorate of the Highland Congregational Church in Boston from 1871 to 1881, he acted as general Sunday-school secretary for Congregationalist churches from 1881 to 1889, and was editor in chief of the *Congregationalist* from 1889 to 1911. He conducted many parties of tourists to the Holy Land. His principal publications are the following: *The Sunday-School Library* (1883); *Bible Studies* (1886), translated into many foreign languages; *Congregationalists in America* (1894).

**DUNNING, JOHN, BARON ASHBURTON** (1731-83). An English lawyer and statesman, born at Ashburton (Devonshire). He studied law at the Middle Temple, was called to the bar in 1756, obtained a high legal reputation, became Solicitor-General in 1768, and in the same year was returned to Parliament for Calne. He very strongly opposed the policy of the ministry in connection with the American Colonies, representing that policy as, "Resist, and we will cut your throats; submit, and we will tax you." In 1774 and again in 1780 he was reelected to Parliament, in 1782 became a member of the Privy Council, and was appointed Chancellor of the Duchy of Lancaster. He wrote *A Defense of*



the United Company of Merchants of England Trading to the East Indies (1762) and has been credited with the authorship of *A Letter to the Proprietors of East India Stock* (1764), a pamphlet entitled *Inquiry into the Doctrines Lately Promulgated Concerning Juries, Libels, etc.* (1764), and a joint share in the *Letters of Junius* (1769-72) (q.v.). Consult Roscoe, *Lives of Eminent British Lawyers* (London, 1838).

**DUNNING, WILLIAM ARCHIBALD.** An American university professor and writer on political science. He was born at Plainfield, N. J., graduated from Columbia University in 1881, and spent four years in postgraduate work. Between 1886 and 1903 he was fellow, lecturer, instructor in political science and history, adjunct professor, and professor of history at Columbia, where he became professor of history and political philosophy in 1904. He was managing editor of the *Political Science Quarterly* (1894-1903). In 1913 he was president of the American Historical Association. Besides magazine articles, he is author of: *Essays on the Civil War and the Reconstruction* (1898); *History of Political Theories, Ancient and Medieval* (1902); *History of Political Theories from Luther to Montesquieu* (1905); *Reconstruction, Political and Economic* (1907); *Carl Schurz's Political Career, 1869-1906*, with Frederic Bancroft (1908); *Paying for Alaska* (1912).

**DUNNOCK** (ME. *donek*, from *donnen*, *dunnen*, *dun* + diminutive *-ek*, *-ock*; so called from the color). A familiar folk name in Scotland and parts of England for the hedge sparrow (q.v.), one of the commonest of British warblers.

**DUNNOTTAR CASTLE.** A ruined castle on the Kincardineshire coast, Scotland, 1½ miles south of Stonehaven. It occupies the top of a rock, 4½ acres in extent and 160 feet high, overhanging the sea, with a deep dry chasm between it and the mainland. It is approached by a steep winding path. It was the ancient seat of the Keiths, earls marischal of Scotland. In 1296 Wallace is said to have taken the rock and the kirk of Dunnottar from the English. During the Commonwealth the regalia of Scotland were hid in the castle from the Republican army, and before the garrison surrendered to Cromwell's troops in 1651 the regalia were removed and secreted in the church of Kinneff. In the time of Charles II and James II the castle was one of the state prisons, where the Covenanters were confined. It was dismantled after the rebellion of 1715, on the attainder of the last earl marischal.

**DUNNVILLE.** A town and port of entry of Haldimand Co., Ontario, Canada, on the Grand River and the Grand Trunk Railway, 43 miles west of Buffalo (Map: Ontario, E 8). The principal establishments include knitting mills, machine shops, a planing mill, a foundry, a cannery, an evaporator, woolen mills; and among the manufactured products are hammocks, bricks, cement blocks, and boats. The town owns its sewerage system. Pop., 1901, 2105; 1911, 2861.

**DUNOIS**, du'nowä', JEAN, COUNT OF (1403-68). A brilliant French soldier, known as "the Bastard of Orleans." He was the natural son of Louis, Duke of Orleans, brother of Charles VI, and of Marietta d'Enghien, the wife of Aubert Flamene, Lord of Cauny. He was brought up in the house of his father, who was murdered in 1407. Attached to the Armagnac faction, Dunois was taken prisoner by the Burgundians

when they captured Paris in 1418 and was not released until two years later. His friends then advised him to enter the church, but his own tastes led him to a military life and he attached himself to the party of the Dauphin Charles. His first battle was that of Baugé, in 1421. He was endowed with the seigniorship of Vaubernais in Dauphiné, and married in 1422 Marie Louvet, the daughter of the Dauphin's favorite adviser. The same year Charles became King and made Dunois a councilor and grand chamberlain. In 1424 he was present at the battle of Verneuil, but the retirement of his father-in-law Louvet, through the intrigues of the Constable de Richemont, led Dunois to withdraw for a time from the service of Charles. In 1427, however, he was again prominent and in the relief of Montargis, besieged by the English, in September of that year, laid the foundation of his military renown. He next undertook the defense of Orléans, which he bravely sustained until the arrival of Joan of Arc with aid. Joining their forces for the reconquest of France, Dunois and the Maid of Orléans entered upon an almost unbroken succession of victories which freed France from the English. The capture of Joan of Arc before Compiègne was a sore blow to Dunois, nor could he save her from being burned at Rouen, though he gallantly attempted a diversion in Normandy. Resuming the campaign, Dunois took Chartres in 1432, and, forcing Bedford from in front of Lagny, he laid the way open to Paris. His operations with Richemont in Lower Normandy and around Paris hastened the conclusion of the Treaty of Arras (1435), by which Philip of Burgundy abandoned the cause of England and went over to Charles VII. Dunois refused to sign the treaty because it did not stipulate for the release of his brother, the Duke of Orleans. He was instrumental in expelling the English from Paris and held a place of honor in the royal entry, November, 1437. After procuring the liberation of the princes of Orleans in 1439, Dunois was more or less involved, for their sake, in the political intrigues of the great nobles against the King, known as the Praguerie. Many new honors and titles were, however, conferred upon him, and between 1446 and 1448 he was employed by Charles VI on diplomatic missions to the Duke of Burgundy, Savoy, and Rome. The war between France and England, having begun again, in 1449, Dunois was named lieutenant general of Normandy, and in a campaign lasting only a year and six days he took all the important strongholds of the English and expelled them from Normandy. Charles VII designated such a conquest as miraculous, and employed Dunois to do the same in Guienne in 1451, where his triumph was equally complete. It has been maintained that, as a reward, Dunois was declared legitimate, but this is not proved. During the wars between Charles VII and the Dauphin Louis, Dunois held Normandy in the name of the King, and was present at the battle of Castillon in 1453. The last years of the great soldier were spent in state affairs. His services and abilities were at first recognized by Louis XI, who employed him in negotiations with the Duke of Brittany in 1462, but as he did not enjoy the confidence of the King, Dunois in 1465 placed himself at the head of the League of the Public Weal and was active in negotiating the Treaty of Saint-Maur. He died at the Château of Hay, Nov. 24, 1468, and was buried in the church of Notre Dame de Cléry, Louis XI

being present at the funeral. Consult the contemporary chronicles by Monstrelet, Basin, and Berry; also Aimé-Champollion, *Louis et Charles d'Orléans* (Paris, 1844); Beaucourt, *Histoire de Charles VII* (6 vols., ib., 1885-91); Vallet de Viriville, *Histoire de Charles VII* (ib., 1862). Dunois appears in Scott's *Quentin Durward*.

**DUNOON**, dūn-oon'. One of the most frequented bathing places and summer residences in the west of Scotland, situated in the southeast of Argyllshire, on the Firth of Clyde, 9 miles west of Greenock (Map: Scotland, D 4). Dunoon Castle, of which only a small part remains, stood on a conical hill near the pier and was once a royal palace and strong fortress. Dunoon was the birthplace of Burns's "Highland Mary" (Mary Campbell), and a statue of her by D. W. Stevenson was erected here in 1898. Pop. (police burgh), 1901, 6779; 1911, 6859.

**DUNRAVEN**. WINDHAM THOMAS WYNDHAM-... EARL OF (1841- ). An English politician. He was born at Adare Abbey, was educated at Christ Church, Oxford, entered the army in 1865, and was war correspondent for the *Daily Telegraph* in Abyssinia and during the Franco-Prussian War. In Lord Salisbury's administrations of 1885-86 and 1886-87 he was Undersecretary of State for the Colonies and from 1888 to 1890 was chairman of the House of Lords Committee on Sweating. He was chairman of the Irish Land Conference (1902-03) and president of the Irish Reform Association, and served in the war in South Africa. He competed unsuccessfully for the America's cup in the international yacht races in 1893 and 1895 with the *Valkyrie II* and *Valkyrie III*. He wrote: *The Great Divide, the Upper Yellowstone* (1874); *The Irish Question* (1880); *Self-Instruction in the Theory and Practice of Navigation* (1900); *The Legacy of Past Years* (1911); *Canadian Nights* (1914).

**DUNSINANE**, dūn'si-nān'. One of the Sidlaw Hills, in the east of Perthshire, Scotland, 1012 feet high, 7 miles northeast of Perth, facing Birnam Hill (q.v.) (Map: Scotland, E 3). On the summit are the faint remains of "Macbeth's Castle," an ancient fortification.

**DUNSMUIR**, JAMES (1851- ). A Canadian capitalist and statesman. He was born at Fort Vancouver, Washington Territory, and was educated at Nanaimo, B. C., Hamilton Collegiate Institute, Ontario, and the Military School, Blackburg, Va. He afterward was trained for business while with his father, who found and developed the first important coal measures in British Columbia, and whom he succeeded as president and chief owner of important coal companies and also as president of the Esquimalt and Nanaimo Railway, which he sold to the Canadian Pacific Railway in 1905. His business enterprises in various directions brought him great wealth. In 1898-1902 he was a Conservative member of the Provincial Legislature; in 1900-02 he was Premier and President of the Council. In 1906-09 he was Lieutenant Governor.

**DUNS SCOTUS**. One of the greatest thinkers of the Middle Ages, who by his acumen displayed in his defense of the doctrine of the Immaculate Conception won for himself the title Doctor Subtilis. He was born either in 1265 or in 1274. The place of his birth is not known. England, Scotland, and Ireland all claim him. He entered the Order of Franciscans, studied at Oxford, and in 1301 became professor of theology there. His prelections were attended by crowds

of auditors. In 1304 he removed to Paris and in 1308 to Cologne, where he died in November of the same year. The general principles of the Scotist system of philosophy deviate only in some points from the Thomist doctrine. (See AQUINAS.) Duns Scotus establishes the necessity of revelation on the ground that reason does not teach us clearly and plainly the highest end of our existence—the intuition of God. In addition to natural knowledge or philosophy, revelation is necessary to enable man to know the fullness of truth and, on the basis of this knowledge, to fulfill his eternal destiny. Revelation therefore supplements and perfects this knowledge, and consequently no contradiction can exist between them. The object of theology is God, as God *sub ratione deitatis*, while philosophy only treats of God in so far as He is the first cause of things. Theology is a practical science, directed not so much to the removal of ignorance as towards the furtherance of our salvation. The incorruptibility and immortality of the human soul he holds to be a truth of faith, which cannot be demonstrated by reason. Duns Scotus was a realist in philosophy (see NOMINALISM) and yet maintained that universals do not need to be differentiated to become individuals. Individuality is original, and the universal, while preëxisting in God's plan, has real existence only in the individuals, from which, by abstraction, the human mind comes to cognize it. The supreme function of mind is, for Duns Scotus, not thought, as for Thomas Aquinas, but will; and he maintained the position by acutely pointing out that clear thought presupposes the exercise of will in attention. Will is free, he taught, and not determined by motives. This is true, not only of men, but of God, who therefore does not, as Thomas Aquinas asserts, command an action because He sees it to be good, but makes it good by commanding it. Duns Scotus had numerous adherents, the best known among whom was Francis of Mayro (died 1325). But when the revival of learning came, the "Dunsmen," or followers of Duns, "raged in every pulpit" against the new classic studies and brought their name into such disrepute as stupid obstructionists that the word "dunce" (= Dunsman) came to mean a "blockhead." The most famous of Duns Scotus's works, besides his commentaries on the Bible and Aristotle, is his commentary on the Sentences of Peter Lombard, called the *Opus Oxoniense*, of which the *Opus Parisiense* is an abridgment. The chief edition of his works is that prepared by his order, and usually assigned to Luke Wadding (12 vols., Lyons, 1639), but it is by no means complete, containing only his philosophical works; nor is it all authentic, as at least one of the volumes is a compilation of lecture notes taken by his hearers. Duns Scotus's works have not received the attention they deserve, and a satisfactory work on his philosophy is still to seek. Consult: Stöckl, *Geschichte der Philosophie des Mittelalters* (Mainz, 1865); Werner, *Duns Scotus* (Vienna, 1881); Pluzanski, *Essai sur la philosophie de Duns Scotus* (Paris, 1887); Siebeck, "Die Willenslehre bei Duns Scotus und seinen Nachfolgern," in *Zeitschrift für Philosophie* (Berlin, 1898); Royce, *Conception of God* (New York, 1898); De Wulf, *Histoire de la philosophie médiévale* (Paris, 1905; Eng. trans., London, 1909); also the histories of philosophy by Ueberweg, Erdmann, and Windelband.

**DUNSTABLE, JOHN** (c.1370-1453). The earliest of the old English composers, probably born at Dunstable, in Bedfordshire. He is buried at St. Stephen's, Walbrook (London). Of his life absolutely nothing is known. In 1847 a three-part chanson, *O Rosa bella*, was discovered, and until the last years of the nineteenth century it remained the only known work of Dunstable. Just before the end of the century several of this composer's works were discovered in the libraries of Oxford, London, Modena, and Bologna. But most important was the discovery of six volumes of manuscript in the library of the cathedral of Trent by F. X. Haberl. In these many of Dunstable's works have been preserved. They include masses, motets, antiphones, and French and Italian songs with instrumental accompaniment. The study of these compositions disclosed the existence of a highly developed art in England during the early part of the fifteenth century, contemporary with and even slightly antedating, the oldest-known French school (Binchois, Dufay).

**DUNSTAN, SAINT** (925?-988). An English archbishop and statesman. He was born at or near Glastonbury, c.910 or 925, and was educated by certain Irish scholars living at the school attached to the old monastery of Glastonbury. Dunstan became a learned scholar, and he was also a musician, a painter, and a worker in metals. After a short time at court, he became a monk and acquired a great reputation for sanctity. Near the church at Glastonbury he erected a cell, five feet in length by two and one-half in breadth, the floor sunk beneath the surface, while the roof on the outside was only breast high. Here, after distributing all his goods to the poor, for he had inherited riches, he led an ascetic life, and the fame of his sanctity spread. He also devoted himself to the study of Scripture and the Fathers of the Church, and became one of the most learned men of his times. On the accession of Edmund to the throne in 940, Dunstan was recalled to court. The King made him Abbot of Glastonbury (c.945), and increased the privileges of the monastery. Under Edmund's successor, Edred, Dunstan enjoyed great favor and now began to distinguish himself as a statesman. He aided in the subjection of the Danes, and instituted religious reforms. Edred was succeeded by Edwy in 955. On the day of the King's coronation, Dunstan publicly rebuked him for an uncanonical marriage, and so won the hatred of the king and that of his wife's family. He was deprived of his offices and banished (956), and his reforms were checked. He fled to Flanders, where he was well received, and lived in Ghent. He returned to England in 958, and was made Bishop of Worcester; in 959 he became Bishop of London, and in 960 Archbishop of Canterbury. King Edgar, who succeeded Edwy in 958, heartily sustained Dunstan's reforms, and, seconded by Oswald, Bishop of Worcester, and Ethelwald, Bishop of Winchester, Dunstan with characteristic energy labored efficaciously for the regeneration of the clergy and the moral advancement of the people. Under Dunstan's counsel Edgar's reign was vigorous and successful. On the death of Edgar, in 975, Dunstan espoused the cause of Edward the Martyr, and succeeded in placing his favorite on the throne. But Ethelred ultimately prevailed, and the power and influence of Dunstan declined. He retired to Canterbury, and died there May

19, 988. Dunstan was ambitious and persistent but guided by sagacity and far-sighted statesmanship. It is often said that he introduced the Benedictine discipline into England. But his religious reforms were certainly conceived and started before his visit to Ghent, when he had his first opportunity of becoming familiar with the Benedictine Order. No authentic literary work of Dunstan is extant. Consult: *Memorials of St. Dunstan*, edited by Stubbs (Rolls Series, London, 1874, a collection of lives, with a valuable introduction); Lingard, *History and Antiquities of the Anglo-Saxon Church*, vol. ii (London, 1809); Wright, *Biographia Literaria*, vol. i, Anglo-Saxon period (London, 1842).

**DUNSTAN, WYNDEAM ROWLAND** (1861- ). An English chemist, born in Chester and educated at Bedford School. He became demonstrator of chemistry at Oxford in 1884, professor to the Pharmaceutical Society in 1886, lecturer at St. Thomas's Hospital in 1892, and director of the Imperial Institute in 1903. He traveled in the tropics and in 1910 was president of the International Association for Tropical Agriculture and Colonial Development. He and his students made important researches in industrial chemistry, e.g., on aconitine and allied alkaloids and on ammonia compounds. His writings were mostly contributions to technical publications (royal and chemical societies) and reports on colonial and tropical industries, such as *Coal Supply of India* (1899), *Agriculture in Asia Minor* (1908), *Cotton Cultivation of the World* (1910).

**DUNSTER, HENRY** (c.1612-59). An American educator, the first president of Harvard College. He was born at Bury, Lancashire, England, and was educated at Magdalene College, Cambridge, where he was associated with Jeremy Taylor and John Milton. He emigrated to Massachusetts in 1640, and in the same year became the first president of Harvard College, of which since 1637 Nathaniel Eaton had been "professor" or "master." He rendered invaluable service to the college, but in 1654 was forced to resign his office for having publicly opposed the doctrine of infant baptism. He was an able preacher, and was widely known as a profound scholar and Orientalist. Consult Chaplin, *Life of Henry Dunster* (Boston, 1872).

**DUNTON, JOHN** (1659-1733). An English bookseller and author. In 1685-86 he visited the Massachusetts Bay Colony, and, having seen John Eliot and acquainted himself somewhat with the native tribes, returned to London to establish a prosperous new business at the Sign of the Black Raven. Subsequently he was involved in debts, became mentally unbalanced, and published his remarkable *Life and Errors of John Dunton* (1705), a strange mixture of nonsense and valuable information regarding himself and many other personages of the time. He published the weekly *Athenian Mercury* (originally the *Athenian Gazette*), from 1690 to 1696, and in 1717 entered into arrangements with Defoe for the publication of another weekly, to be called *The Hanover Spy*. His many political tracts in support of the Whigs were unrecognized by the ministry. His *Letters from New England*, edited by Whitmore, were published in New York in 1867.

**DUNTON, THEODORE WATTS.** See WATTS-DUNTON, THEODORE.

**DÜNTZER, JÖHANN HEINRICH JOSEPH** (1813-1901). A German philologist and

literary historian, born in Cologne. He studied at the universities of Bonn, Cologne, and Berlin, and in 1846 was appointed librarian of the public library in the Catholic gymnasium at Cologne. His publications on philological subjects include: *Die Lehre von der lateinischen Wortbildung* (1836); *Kritik und Erklärung der horazischen Gedichte* (1840-46); *Verzeichniss der römischen Altertümer des Museums Wallraf-Richartz in Köln* (3d ed., 1885); and school editions of *Homer* (2d ed., 1873 et seq.), and *Horace* (with Latin commentary, 1849; with German commentary, 1868-69). He also published more than 20 biographical and critical works on Goethe, of which the biography entitled *Goethes Leben* (2d ed., 1883) has been translated into English by Lyster (1884). His biography of Goethe, and similar works on Schiller, Lessing, and Herder, are characterized by scholarly research and accuracy, but lack inspiration and charm of style.

**DUNWOODY, HENRY HARRISON CHASE** (1842- ). An American meteorologist, born in Highland Co., Ohio. He graduated at the United States Military Academy in 1866. After serving in the Fourth United States Artillery from 1866 to 1869, he was recorder of the Tactics Board at St. Louis, Mo., for two years. He was associated as meteorologist with the Signal Office at Washington for nearly 20 years. He promoted the establishment of weather services in the various States, and systematized the official forecasts and so-called hot and cold wave predictions. In recognition of his important work on the Signal Corps he was promoted to the rank of major in 1889. He was made colonel in 1898, and was retired as brigadier general in 1904. His papers on meteorological subjects include the following: *Decrease of Temperature with Elevation and Reduction of Barometer to Sea Level*; *Tables of Rainfall and Temperature Compared with Crop Production*; *Weather Proverbs*; *Absolute Humidity and Mean Cloudiness in the United States*; *Geographical Distribution of Rainfall in the United States*.

**DUODECIMAL SCALE** (from Lat. *duodecim*, twelve). The name given to the division of any unit into 12 equal parts, as the division of the foot into 12 inches. See NOTATION; ARITHMETIC.

**DU'ODE'NUM.** See INTESTINES.

**DUOVIRI.** See DUUMVIRS.

**DUPANLOUP, du'pā'n'lō', FÉLIX ANTOINE PHILIBERT** (1802-78). A French prelate. He was born at St. Félix, Savoy; was ordained priest in Paris in 1825, and became confessor to the Duke de Bordeaux (afterward Count de Chambord) in 1827, and Bishop of Orléans in 1849. Under Louis Philippe he was a leader among the Liberal Catholics; under Napoleon, the foremost champion of the temporal independence of the Pope. Before the Vatican Council and in the Council in 1870 he opposed papal infallibility, but he submitted to the decision of the Council. At the close of the war with Germany he was sent as a representative to the National Assembly, where he favored a constitutional monarchy. Dupanloup became a member of the French Academy in 1854—in 1863 he opposed the election of Littré, at the same time attacking Taine and Renan—and a senator in 1875. He urged the advantage of keeping Latin in the school curriculum, and his best works are *De l'éducation* (1855-57) and *De la haute éducation* (1866). His *Histoire de Jésus*

(1872) was a reply to Renan. His *Œuvres choisies* were published in 1861. He has a fine tomb in the Orléans cathedral. Consult Pelletier, *Monseigneur Dupanloup* (Paris, 1876), and a *Life* (1883; 7th ed., 1894) by Lagrange, Eng. trans. by Lady Herbert (London, 1885).

**DUPERRON, du'pā'rōn', JACQUES DAVY** (1556-1618). A French prelate. He was born at Saint-Lô, Normandy, the son of Protestant parents, who had to flee soon afterward from Normandy to Bern, Switzerland. He succeeded in winning a position at court, and the protection of the Duke de Joyeuse, and became a Roman Catholic in 1577 or 1578. He was appointed reader to King Henry III, and, though a layman, preached at Vincennes, and on the death of Mary, Queen of Scots, was chosen to pronounce her eulogy. His success in oratory and his ambition led him to take orders. Toward the end of the reign of Henry III he attached himself to the Cardinal de Bourbon, and is said to have sold the latter's secrets to Henry IV, whose conversion to Catholicism was under Duperron's teachings and who made him Bishop of Evreux. With Cardinal d'Ossat, Duperron persuaded the Pope to relieve the kingdom of the interdict, and for his services received the cardinal's hat in 1604. In all theological disputes he took an active part against the Protestants. He wrote many controversial works, some ballads, and an elegy, *L'Ombre de M. l'amiral de Joyeuse* (1588). The *Perroniana* (1666), by Dupuy, is a famous collection of Ana. Consult Féret, *Le Cardinal Duperron* (Paris, 1876).

**DUPES, DAY OF** (Fr. *journée des dupes*). The name given in France to Nov. 11, 1630, because on that day Richelieu foiled the enemies who had nearly succeeded in ousting him from the royal favor.

**DUPETIT-THOUARS, du'p'-tē'tō's'ar', ABEL AUBERT** (1793-1864). A French naval officer, born near Saumur. In 1839 he completed a voyage around the world as captain of the *Venus*. In 1842 he placed the Marquesas Islands, and the following year the whole Society group, under the protection of France. In 1846 he was made vice admiral and in 1849 was elected to the Legislative Assembly. He published *Voyage autour du monde sur la frégate La Venus* (1841-49).

**DUPETIT-THOUARS, LOUIS MARIE AUBERT** (1758-1831). A French botanist, born at Boumois, near Saumur. In 1792 he accompanied his brother, Aristide Aubert, a naval commander, to Madagascar and the neighboring islands, where he collected numerous botanical specimens. In 1802 he returned to Paris, where he was appointed director of the Royal Institute of Arboriculture. The results of his extensive travels in the Eastern island were published in a series of works of which the publication entitled *Histoire des végétaux recueillis sur les îles de France, de Bourbon et de Madagascar* (1804), is probably the most important.

**DUPIN, du'pān', ANDRÉ MARIE JEAN JACQUES** (1783-1865). A French lawyer and statesman. He was born at Varzy, in the Department of Nièvre, and studied in Paris. After failing, in 1810, to secure a professorship in law, he devoted himself to active practice at the bar until he was elected, in 1815, a member of the Chamber of Deputies. The publication of his treatise, *De la libre défense des accusés*, caused him to be chosen as counsel for Marshal Ney and others

in the trials for treason and sedition that followed the restoration of the Bourbons. In his pamphlet, *La révolution de 1830*, he endeavored to prove the lawful character of this revolution, and showed himself an ardent defender of the rights of the bourgeoisie. Louis Philippe made him his intimate counselor and procurator general of the Court of Cassation. In 1832 he became a member of the Academy. From 1832 to 1840 he was president of the Chamber of Deputies. He was on the legislative committee which drafted the new constitution after the revolution of 1848, and was president of the Legislative Assembly at the time of the coup d'état. In consequence of the confiscation of the Orléans estates in 1852, Dupin resigned his place and retired for a time from public life; but in 1857 he consented to resume his previous office of procurator general of the Court of Cassation. Of his many important works there may be mentioned the *Glossaire de l'ancien droit français* (1846) and *Opuscules de jurisprudence* (1851). Consult his *Mémoires* (Paris, 1855-63).

**DUPIN, CHEVALIER AUGUSTE.** The famous character introduced by Edgar Allan Poe as a French detective into several of his short stories, notably *The Murders in the Rue Morgue* and *The Mystery of Marie Rogét*. The type thus created by Poe was imitated by Conan Doyle in his Sherlock Holmes stories.

**DUPIN, LOUIS ELLIES** (1657-1719). A French Jansenist theologian and historian. He was born in Paris, where he became professor at the Royal College. He was exposed to severe criticism because of his attitude towards William Wake, Archbishop of Canterbury, and his attempts to unify the Gallican and English churches. His *Bibliothèque universelle des auteurs ecclésiastiques* (58 vols., 1686-1704) is a complete history of the theological literature of the church and is recognized as a standard work, not only as regards the numerous biographical sketches contained in it, but also because of its exhaustive list of works and the criticisms and other data bearing on them. It and many other of his works were put on the Index. Consult the autobiographic matter in the last volume (1704) of the *Bibliothèque universelle*.

**DUPIN, PIERRE CHARLES FRANÇOIS, BARON** (1784-1873). A French economist and politician, brother of André Dupin. He was born at Varzy, in the Department of Nièvre, was educated at the Polytechnic School in Paris, and was afterward employed as inspector general of the Marine Department. He traveled in England for the purpose of studying its industries and commerce, and on his return he published *Voyages dans la Grande-Bretagne* (1820-24). In 1819 he was made professor in the Conservatoire des Arts et Métiers, but his interests became more and more centred in politics, in which he at first showed liberal leanings, but finally took up the cause of the Bourbons. In 1828 he was elected deputy for the Department of Tarn and took part with the moderate opposition, though Charles X had made him Baron four years earlier. After the February revolution of 1848 Dupin was elected member of the Constituent Assembly and later of the Legislative Assembly, and after the coup d'état he became a senator for life. His mathematical treatise, *Développement de géométrie pour faire suite à la géométrie pratique de Monge* (1813),

gave him membership in the Académie des Sciences. His works also include: *Trois forces productives et commerciales de la France* (1825); *Bien-être et concorde des classes du peuple français* (1841); *Forces productives des nations de 1800 à 1851* (1851), the last being his chief work.

**DUPLEIX, du'plaks', JOSEPH FRANÇOIS, MARQUIS** (1697-1764). A French colonial governor-general, celebrated as the opponent of British supremacy in India. He was born at Landrecies, a town not far from Valenciennes, Jan. 1, 1697, and was carefully educated by his father, a rich . . . He made several voyages to America and India, which engendered a remarkable aptitude for business enterprise. In 1720 he went as member of the Superior Council to Pondicherry, where he soon gained a large private fortune. In 1731 he proceeded to Chandernagar as Intendant, and in four years, by his energetic and prudent measures, backed by his own capital, had converted that "decayed and lifeless" town into a thriving port. His success received due recognition, and in 1742 he received the position and title of "General Commandant of the French possessions in India." He soon disclosed the genius of an empire builder, with splendid schemes for territorial acquisition, in which he was ably seconded by his wife, Jeanne Albert de Castro, celebrated in Indian annals as Joanna Begum, the "Princess Joanna." His efforts, however, to form alliances and to strengthen his position received little support from the French East India Company or the French government; he was ordered to cease all outlay on the fortification of Pondicherry, but continued the work mainly at his own expense. In 1745 the struggle known as the War of the Austrian Succession, in which France and England were arrayed against each other, extended to the Indian peninsula. The English East India Company, alarmed at Duplex's activity, had fortified Madras. At first the French were successful; with the help of Labourdonnais, Governor of the Isles of France and Bourbon, Duplex repulsed an English attack under Commodore Barnett on Pondicherry, and in 1746 Madras was captured by Labourdonnais, but the results were fruitless, owing to the mutual jealousies of that commander and Duplex. Duplex refused to restore Madras to the English according to a compact entered into by Labourdonnais and sent the latter, on a charge of treason, to France. The same year Duplex was ennobled. He was successful in several brilliant engagements against the Nawab of the Carnatic, who had a personal grievance in connection with the retention of Madras; in 1748 he compelled Admiral Boscawen to raise the siege of Pondicherry after an attack of five weeks. The Peace of Aix-la-Chapelle put an end to hostilities and restored Madras to the English, much to Duplex's chagrin. He nevertheless continued his plans and negotiations for the subjection of southern India, and by 1751 the Deccan and the Carnatic were practically under French domination, and Duplex's dream of making the power of France paramount in India seemed realized. Acting in accordance with tried French methods, Duplex treated the natives in a most cordial manner. He married an Indian-born Portuguese woman well acquainted with Hindu, lived in utmost royalty and splendor, and was profuse in his gifts to

needy natives. But Madame Pompadour in Paris, and other influential people around the King, had no aspirations for French Empire. Troops and supplies were both denied Dupleix, and the English got the upper hand. They knew that Dupleix stood in the way of their success. From the English East India Company came the suggestion that peace and amity might be restored in the Far East if only the French East India Company would recall their firebrand Governor. The French acquiesced, and in 1753 sent Goodhue with a body of troops, ostensibly to assist, but in reality to recall, the great French Proconsul. Dupleix quietly submitted, and the opportunity of a French India slipped by forever.

For the company he had expended \$1,200,000 of his private fortune. In addition he had advanced large sums to his native allies on the security of the revenue of certain districts. He was never repaid. Neglected by his ungrateful country, the ablest statesman of Louis XV's reign was allowed to die in want and obscurity in Paris, Nov. 10, 1764.

Consult: Malleon, *Dupleix* (Oxford, 1890); Bionne, *Dupleix* (2 vols., Paris, 1881); Guet, *Origines de l'Inde française* (ib., 1892); Fosses, *Dupleix, ses dernières luttes dans l'Inde* (ib., 1889); Cultru, *Dupleix, ses plans politiques; sa disgrâce* (ib., 1901); Weber, *La compagnie française des Indes* (ib., 1904).

**DU PLESSIS.** See RICHELIEU, DUC DE.

**DU PLESSIS-MORNAY**, mōr'nā', PHILIPPE (1549-1623). A distinguished French Protestant leader, frequently called "the Huguenot Pope." He was born at Buhy, in Normandy, of nominally Catholic parents, who destined him for the priesthood, but early in life he declared himself a Protestant. His convictions were strengthened by visits to Geneva and Heidelberg, then the centre of Calvinism, during four years of travel (1568-72). On his return to France he attached himself to Coligny, whose fate he escaped on the night of St. Bartholomew. He remained in England for a year, but came back to take up arms for the Huguenot cause. He was captured by Guise at the siege of Dormans in 1575, but, not being recognized, gained his liberty by the payment of a small ransom and took refuge with the Duke of Bouillon at Sedan. Here he married a young widow, Charlotte Arbaleste. Henry of Navarre sent him to England as a personal representative in 1577, and during this period he wrote a number of theological works. On Condé's death in 1588 he was recognized as the head of the Huguenot faction and had much influence with Henry III, whom he persuaded to legalize the preaching of the reformed doctrine throughout France. He also succeeded in bringing about an understanding between the King and his future successor, and his services were recognized by his appointment as Governor of Saumur, where he made things so difficult for the Catholics that many of them fled from the district. After the murder of Henry III he took a prominent part in the military and other movements which brought Henry of Navarre to the throne, but the latter's conversion ended his official activity. He lost his position in the King's Council, but retained his governorship, building at Saumur a Protestant church and college for the education of preachers. His scheme for the organization of French Protestants was adopted by the gathering at Sainte-

Foy in 1594, and he was concerned in the negotiations which led up to the Edict of Nantes. The principal event of his later years was his famous controversy with Duperron, the learned Bishop of Evreux, who accused him of misquotation and garbling in one of his controversial treatises, and met and routed him in a public disputation. Du Plessis was deprived of his office at the time of the Huguenot rising of 1621 and died in retirement on his estate of La Forêt-sur-Sevre two years later. Consult his *Mémoires et correspondance*, republished in 12 vols. (Paris, 1824-25); also Ambert, *Du Plessis-Mornay* (ib., 1847), and Baird, *The Huguenots and Henry of Navarre* (New York, 1886).

**DUPLICATION OF THE CUBE.** See CUBE. **DUPPLICIDENTATA.** See RODENLIA.

**DUPLOYÉ**, dū'plwā'yā', EMILE (1833-1912). A French stenographer, born at Notre Dame de Liesse (Aisne). He was for a time an abbé, but afterward became known as the inventor of a skillful and widely used system of stenography. With his brother Gustave, he published a textbook in exposition of this method (4th ed., 1867). Consult the article by Meyer in No. 436 of the *Archiv für Stenographie* (Berlin, 1885).

**DUPONCEAU**, dū'pōn'sō', PETER STEPHEN (1760-1844). An American writer and scholar. He was born at Saint-Martin, Île de Ré, France, studied law at the college at Bressuire, and became secretary to Baron Steuben, with whom in 1777 he came to America and entered the Continental army, in which he was commissioned a captain, serving with Steuben in the New Jersey and Pennsylvania campaigns and in the South. He left the army in 1781 and became a translator and correspondent in the office of the Secretary for Foreign Affairs, Robert R. Livingston. He remained in that position until the close of the war, when he settled in Philadelphia, where he began the practice of law in 1785 and attained high rank as an advocate. After the purchase of Louisiana President Jefferson offered him the appointment of Chief Justice of the Territory, but he declined. In addition to original legal treatises and translations of French and German legal works, Duponceau devoted himself to philology. Among his published works are: *English Phonology* (1818); *Exposition sommaire de la constitution des Etats-Unis d'Amérique* (1837); *Mémoire sur le système grammatical des langages de quelques nations indiennes de l'Amérique du Nord* (1838), which won for him a medal from the French Institute; *Dissertation on the Nature and Character of the Chinese System of Writing* (1838).

**DU PONT**, HENRY ALGERNON (1838- ). An American soldier and legislator, born near Wilmington, Del. After graduating from the United States Military Academy in 1861, he served through the Civil War, taking part in the battles of New Market, Piedmont, Lynchburg, Opequan, Fisher's Hill, and Cedar Creek, and being brevetted lieutenant colonel in 1864. He resigned from the army in 1875. Du Pont was the opponent of John Edward Addicks (q.v.) in a famous struggle in Delaware for a seat in the United States Senate, a struggle which lasted nearly 20 years and resulted in several deadlocks. The contest finally ended with the election of Du Pont in 1906; in 1911 he was reelected for the term ending 1917.



**DUPONT**, du'pôn', PIERRE (1821-70). A French song writer. He was born in Lyons, the son of a workman; was brought up by his cousin, who was priest of Roche Taillière-sur-Saône; studied in the seminary of Largentières, and afterward passed a short time in a lawyer's office. His poem *Les deux anges* was printed in 1842 and won a prize in the Academy. Dupont afterward wrote some republican verses that came . . . his banishment. He owes his . . . the songs written for the peasants, such as *Les bœufs*, *Les lapins*, and *Le chanson du pain*. Collections of his songs published include *Chants et chansons* (3 vols., 1852-54) and *Chants et poésies* (7th ed., 1862). Consult Dechant, *Biographie de Pierre Dupont* (1871).

**DU PONT**, SAMUEL FRANCIS (1803-65). A United States naval officer. He was born at Bergen Point, N. J., entered the navy in 1815, and in 1845 had been promoted to the rank of commander. In the Mexican War, as commander of the *Cyane*, he captured San Diego and La Paz, Cal.; served under Commodore Shubrick in the capture of Mazatlan; and, at the head of a naval force, defeated a large body of Mexicans at San José. In 1855 he was promoted to be captain and in December, 1860, was placed in command of the Philadelphia Navy Yard. In June, 1861, he became president of a board of naval officers appointed to formulate a plan of naval operations against the Confederates, and in September was appointed to the command of the South Atlantic squadron, which in a series of brilliant operations captured Port Royal, S. C., St. Mary's, Fernandina, Jacksonville, Fort Clinch, and St. Augustine, Fla., besides establishing 14 blockading stations. For this he received the thanks of Congress and was raised to the rank of rear admiral (July 16, 1862). On April 7, 1863, as commander of nine armored vessels, he made a determined attack upon Charleston, S. C., but was repulsed with considerable loss. Admiral Du Pont was relieved by Admiral Dahlgren in July of that year and took no further part in the war. For his services during the Civil War, consult Ammen, *The Atlantic Coast* (New York, 1883).

**DUPONT DE L'ETANG**, du'pôn' de là'tân', PIERRE ANTOINE, COUNT (1765-1840). A French general, born at Chabanais. His services in the Northern armies during the wars of the Revolution won Carnot's attention and brought him promotion. He participated in the overthrow of the Directory and served with great distinction at Marengo, Jena, and Friedland, but his unsuccessful expedition to Spain in 1808, where at Baylen he was compelled to surrender his army, brought about his disgrace and imprisonment. After Napoleon's downfall he was Minister of War during the Hundred Days, and during the second restoration became a member of the Privy Council. Consult Titeux, *Le général Dupont* (Paris, 1903).

**DUPONT DE L'EURE**, de lër, JACQUES CHARLES (1767-1855). A French statesman, born at Neubourg, Normandy. He was an advocate before the Parliament of Normandy in 1789 and held various judicial offices during the Revolution. He entered political life as a member of the Council of Five Hundred in 1798. He was chosen a deputy from the Eure to the Corps Législatif in 1813 and in the fol-

lowing year was elected to the Chamber of Deputies, by which he was chosen vice president. Re-elected in 1815, he was the author of the famous declaration of the Chamber to the Allies, that France would recognize a government that would not guarantee to it the liberties which had been established by the Revolution. From 1817 to 1848 he was member of the Chamber of Deputies, acting consistently with the Liberal opposition. In 1830 for a few months he held the portfolio of Justice in the first cabinet of Louis Philippe. After his resignation he continued as a leader of the opposition until the revolution of 1848 when he was chosen President of the provisional government. He retired to private life in the following year. In all his long career his probity and disinterestedness were never questioned, and his sterling honesty and consistent advocacy of constitutional liberty won for him the title of the "Aristides of the French tribune."

**DUPONT DE NEMOURS**, du'pôn' de ne mōor', PIERRE SAMUEL (1739-1817). A French statesman and writer on finance and an exponent of the theories of the physiocrats (q.v.). He was born and educated in Paris. In 1771 he was Secretary of the Council of Public Instruction in Poland. He went back to France two years afterward to assist his friend Turgot in the administration, and with Turgot went into retirement in 1776. In 1782 Vergennes intrusted him with the task of drafting the treaty recognizing the independence of the United States. Subsequently he was a member of the Council of State and Commissary General of Commerce. During the Revolution he favored a constitutional monarchy, but was compelled to hide when the Republic triumphed. He was found and imprisoned, but Robespierre's fall saved him. His reactionary attitude in the Council of Ancients made him exceedingly unpopular and caused him to emigrate to the United States in 1799. He returned to France in 1802, but declined all political office, except that of a commissioner to arrange the transfer of Louisiana to the United States. Jefferson requested Dupont to prepare a scheme of national education. The scheme was never adopted in the United States, but some of its features were embodied in the French code. After Napoleon's first downfall Dupont became secretary to the provisional government, and on the restoration of the Bourbons was made a counselor of state. The return of Napoleon caused him to leave France, and he spent the remainder of his life with his two sons, powder manufacturers, in the State of Delaware. Dupont de Nemours was the author of several tracts on political and economic matters. Consult Schelle, *Dupont de Nemours et l'école physiocratique* (Paris, 1888).

**DU PONT POWDER**. See EXPLOSIVES.

**DÜPPEL**, düp'pel, or DYBBÖL. A village in the Prussian Province of Schleswig-Holstein situated on the peninsula of Sundewitt, 16 miles northeast of Flensburg. Engagements took place here between the Danes and Germans in May and June, 1848, in which the latter were repulsed; but on April 13, 1849, the Germans stormed the place. In the second Schleswig-Holstein War the lines of Düppel were carried by the Prussians, April 18, 1864. Pop., 600. Consult R. Neumann, *Ueber den Angriff der*



*düppeler Schanzen in der Zeit von 15 Marz bis 18 April, 1864* (Berlin, 1865).

**DU PRAT**, du'prá', ANTOINE (1463-1535). A chancellor of France, born at Issoire (Auvergne). He became President of the Parlement of Paris under Louis XII, and Francis I, on his accession to the throne in 1515, appointed him Chancellor. As such he entered into relations with Pope Leo X regarding the Pragmatic Sanction and concluded the concordat by which both the church and the nobility of France were entirely subject to the royal authority. In concluding this agreement he encountered great opposition, chiefly on the part of the clergy and the university, but retained the royal patronage, by which he ultimately secured the archbishopric of Sens and the cardinalate. He advanced the absolute power of the state and has therefore justly been called the predecessor of Richelieu and Mazarin. It is said that he might have been the successor of Pope Clement VII but for the influence of Francis I, who desired to retain his services. Consult *Marquis Du Prat, Vie d'Antoine Du Prat* (Paris, 1857).

**DUPRÉ**, du'prá', GIOVANNI (1817-82). An Italian sculptor of French descent. He was born at Siena March 1, 1817, and first practiced wood carving at Florence, which he made his home. Although almost entirely self-taught, he won the first prize for sculpture at the Florentine Academy in 1840. Dupré began as a naturalist, but later he learned from Bartolini and others the doctrine of purism, which interfered with the free development of his art. He first gained celebrity with the beautiful recumbent figure of "Abel" (1842, St. Petersburg; replica in Pitti Palace, Florence), but its companion piece, "Cain" (1845, Pitti Palace), was a comparative failure. These were followed by the pedestal for a colossal vase (also in the Pitti), and an unsuccessful design for the monument to the Duke of Wellington. Both show his taste for allegory, which was later developed to excess. His next important work was the bas-relief over the main door of the church of Santa Croce, representing the "Triumph of the Cross" (1862), and the same year he began his masterpiece, the "Pietà," in the campo santo of Siena, a work of remarkable beauty of expression and harmony of lines and planes. For this group he was awarded the gold medal at the Paris Exposition of 1867. In 1868 he was made corresponding member of the French Institute. Other statues by him include the "Despairing Sappho," "Giotto," in the portico of the Uffizi, and "St. Francis" in Assisi. He was not fitted for imposing conceptions and seriously damaged his reputation by the monument to Cavour in Turin (1866-73), his last important undertaking. Dupré's work is forcible, and his anatomy and drapery admirable, but in portrait sculpture he shows lack of individuality and personality. His autobiography, *Pensieri sull' arte e ricordi autobiografici*, appeared in 1879 (trans. by Peruzzi, 1884). Consult Frieze, *Giovanni Dupré* (London, 1886), and Venturi, *Scritti minori e lettere di Giovanni Dupré, con un appendice ai ricordi autobiografici* (Florence, 1885).

**DUPRÉ**, JULES (1812-89). A French landscape painter of the Barbizon group. He was born at Nantes, April 5, 1812. His father was a porcelain manufacturer at Parmain and afterward in Limousin, and the lad's first experience in design was gained in decorating porcelain

in his father's factory. Some sketches which he made in Limousin attracted the attention of amateurs, and Jules was enabled to go to Paris. He was little influenced by his official teachers, much more by the paintings of Hobbema and Ruysdael, in the Louvre, and always sought inspiration in Nature herself. He was profoundly impressed by the pictures of the Barbizon painters, attaching himself especially to Rousseau, who became his fast friend and greatly influenced his art. In the memorable Salon of 1831 he exhibited fine studies from nature made in Haute Vienne, among which were "Interior of a Forest," "View of Isle Adam," and "Interior of a Courtyard." They attracted great attention, as did his exhibits of 1833: "Evening," "Environs of Paris," and the "Valley of Montmorency." In 1834 he painted his famous "Farmyard," and, at the invitation of Lord Graves, one of his patrons, he visited England in the same year. He was greatly impressed with the English landscapists, especially by Constable, whose work much influenced his. One of the results of this trip was his picture, "Environs of Southampton," exhibited in 1835, a wonderful representation of a storm sweeping across an undulating country. In the same year he exhibited a "Wood in Creuse" and "Pasture in Limousin." In the latter picture he has accomplished the difficult task of rendering the effect of a hot summer's day, with its strong contrasts of bright colors just after a rain.

In 1852 he exhibited "Sunset," "Pastureland," and "Entrance to a Village," all excellent works. He did not again exhibit until the Paris Exposition of 1867, to which he sent 12 canvases, including the "Forest of Compiègne," the "Gorge of Eaux Chaudes," and "Pastures of Berry." During the War of 1870 he resided at Cayeux-sur-Mer and found in its barren and lonely neighborhood subjects which well expressed his own melancholy. The marines which he painted at this time, like his "Moonlight," belong to his best work. After the war fortune began to smile upon him, and in 1872 he was able to buy his now historic house at L'Isle Adam. He passed the rest of his life surrounded by his pupils and friends, to whom he communicated his ideas on art in an original fashion. In the Exposition of 1889 there were exhibited, besides his older works, eight others which showed his vigor unimpaired, such as a "Road in the Park of Stors," a "Storm at Sea," a "Ravine in Marais." He died at L'Isle Adam, Oct. 6, 1889—a beautiful and unselfish character, loved by all with whom he associated. The Louvre possesses 16 of his paintings, and American museums, both public and private, are rich in his works. The Metropolitan Museum, New York, possesses excellent examples—the "Old Oak," "Hay Wagon," and a landscape, "Summer"—and the Vanderbilt collection, now on exhibition there, is even richer; its "Midday" is one of his best works. In the Walters Gallery, Baltimore, there are "A Bright Day," "The Old Oak," "Sunset on the Coast," and "At Sea."

Dupré was one of the greatest painters of the Barbizon school—the dramatist of the group, as Rousseau was the epic and Corot the lyric poet. He was a melancholy spirit and loved to portray the tragic, the gloomy, the terrible in nature. He attached especial importance to the handling of light in a picture, and, in order to accomplish this, he often made such free use of impasto that his pictures almost became

reliefs. His colors are bright: it has been well said that "he sees nature through a prism." But they are harmonious, and he excels in his contrasts. He was made chevalier of the Legion of Honor in 1849, officier in 1870, and received the gold medal of honor at the Exposition of 1889. Consult: Clarétie, *Peintres et sculpteurs contemporains*, deuxième série (Paris, 1899); Hustin, "Jules Dupré," in *Les artistes célèbres*; *Les hommes du jour*: M. Jules Dupré, par un critique d'art (Paris, 1879); and the articles by Ménard, in *L'Art* (1879), and by Michel (ib., 1883), and the works cited under BARBIZON, THE PAINTERS OF. For his engravings, consult Delteil, *Le peintre-graveur illustré*, vol. i (Paris, 1906).

**DUPRÉ, JULIEN** (1851-1910). A French painter, born in Paris. He studied under Pils and Henri Lehmann. He renders with robust spirit the simple scenes of country life and is noted for his painting of animals, particularly of cows, and his fresh, brilliant landscapes. In the 1889 Exposition are his "Mowers of Lucerne" and "The Return of the Herd." At the St. Louis Exposition (1904) he exhibited "The Return of the Herd," one of his best works, "Evening," and "Near a Pool."

**DUPUIS, du'pwé', CHARLES FRANÇOIS** (1742-1809). A distinguished French savant, the son of a poor schoolmaster. He was born at Trie-Château, near Chaumont, and obtained admission into the College of Harcourt, where he so soon acquired extensive knowledge that at the age of 24 he was made professor of rhetoric in the College of Lisieux. At the same time he went through a course of law studies and was admitted an advocate of the Parliament. His acquaintance with Lalande introduced him to the study of mathematics and astronomy, and he was led to the thought of explaining mythology by means of astronomy. After several communications in the *Journal des Savants*, appeared his *Mémoire sur l'origine des constellations et sur l'explication de la fable par le moyen de l'astronomie* (1781). He was now appointed professor of Latin oratory in the Collège de France, member of the Académie des Inscriptions (1788), and shortly after a member of the Commission of Public Instruction. During the Revolution he became a member of the Convention, next of the Council of Five Hundred, and, after the eighteenth Brumaire, of the legislative body. He was also one of the 48 individuals who formed the nucleus of the Institut National. His great work, *L'Origine de tous les cultes, ou religion universelle* (1795), which he had long withheld from fear of offending the religious world, was at last published at the instance of the Cordeliers' Club. This circumstance rendered the book more an object of party bitterness than its own purely scientific character would probably have called forth. It made a considerable impression on France at the time and no doubt afterward caused Napoleon to appoint the famous commission to explore Upper Egypt, which Dupuis had pointed out as the general source of southern mythology. No less attention was awakened by his memoirs on the origin and spread of the Pelasgi and on the zodiac of Denderah (q.v.). In his last work, *Mémoire explicatif du zodiaque chronologique et mythologique* (1806), he attempts to demonstrate the unity of the astronomical and religious myths of all nations.

**DUPUIS, NATHAN FELLOWES** (1836- ).

A Canadian educator and author, born at Portland, Ontario. He graduated in 1866 at Queen's University (Kingston) and in 1867 was appointed professor of chemistry in that institution. In 1880 he was transferred to the professorship of mathematics. He was for a number of years public inspector of schools for Kingston. His publications include: *Elements of Geometrical Optics* (1868); *Junior Algebra* (1882); *Elements of Synthetic Solid Geometry* (1893); *Elements of Trigonometry for Practical Science Students* (1902); *Spherical Trigonometry and Astronomy* (1906); *Descriptive and Mechanical Astronomy* (1910).

**DUPUY, CHARLES ALEXANDER** (1851- ). A French premier, born at Le Puy (Haute-Loire), France, and educated at the Lycée of Le Puy and the Lycée Charlemagne at Paris. He was professor of philosophy at the colleges at Nantua and Aurillac, taught in several lycées, and was later a school inspector for the academies of Lozère and Calvados and vice rector of the Corsican College at Ajaccio. Entering politics, he became a deputy for Haute-Loire in 1885, was reelected in 1889, was Minister of Public Instruction in 1892, and President of the Chamber of Deputies in 1893. He served twice as Premier and Minister of the Interior (1893-95 and 1898-99). In 1900 he became senator for Haute-Loire. He published *Livret de morale* (1891).

**DUPUY, JEAN** (1844- ). A French politician, journalist, and administrator, born at Saint-Palais, Gironde. He became proprietor of the *Siècle* (1886) and of the *Petit Parisien* (1888) and then president of the Paris press syndicate. Elected to the Senate as a radical Republican in 1891, he took a prominent part in debates on finance and agriculture. He was Minister of Agriculture in Waldeck-Rousseau's cabinet in 1900-1902, of Commerce in Briand's (July, 1909-February, 1911) and of Public Works from January to March, 1913.

**DUPUY DE LÔME, du'pwé' de lôm, STANISLAS CHARLES HENRI LAURENT** (1816-85). A French naval engineer. He was born at Ploemeur, near Lorient, and was educated at the Ecole Polytechnique in Paris, and in England. In 1857 he was chief of department in the Ministry of the Navy and was subsequently appointed director of naval construction. The *Napoléon*, the first iron steamship constructed in France, was modeled upon the principles laid down in his *Mémoire sur la construction des bâtiments en fer* (1844). The first French screw steamships and the first armored vessels, *La Gloire*, *Invincible*, and *Normandie* (1859), also were built in accordance with his instructions. During the siege of Paris he was a member of the Aérostatie Commission and in this capacity organized the service which sent out more than 50 balloons from the city before the capitulation. In 1872 he demonstrated the possibility of constructing dirigible balloons. He was elected deputy in 1869 and senator for life in 1877. See ARMOR PLATE.

**DUPUYTREN, du'pwé'trân', GUILLAUME, BARON** (1777-1835). An eminent French surgeon and anatomist. He was born at Pierre-Buffière, in Limousin, was educated at the Collège de la Marche in Paris, and on the formation of a new school of medicine there in 1794, was appointed to the office of prosector. In 1812 he became professor of surgery and in 1815 chief surgeon to the Hôtel-Dieu. Louis

XVIII conferred on him the title of Baron, and appointed him royal surgeon in 1823. Dupuytren was a remarkable physiologist as well as a bold and skillful operator. He made several important discoveries in pathological anatomy, and, although he wrote little, he formed a large school of enlightened surgeons in his native country. Among his works may be mentioned: *Leçons orales de clinique chirurgicale faites à l'Hôtel-Dieu* (1830-34); *Traité théorique et pratique des blessures par armes de guerre* (1834); *Mémoire sur une nouvelle manière de pratiquer l'opération de la pierre* (1836).

**DUQUESNE**, dōō-kān'. A borough in Allegheny Co., Pa., 12 miles north of Pittsburgh, on the Monongahela River, and on the Pennsylvania Railroad. It has a Carnegie library and institute. Its steel works and blast furnaces are extensive. Settled in 1885, Duquesne was incorporated in 1891. Under the charter of that date the government is vested in a burgess, elected every three years, and a borough council. The water works are owned and operated by the municipality. Pop., 1900, 9036; 1910, 15,727; 1914 (U. S. est.), 18,576.

**DUQUESNE**, du'kān', ABRAHAM. MARQUIS (1610-88). One of the most eminent naval officers of France. He was born at Dieppe and was trained for the naval service. Under Louis XIII he distinguished himself in the war against Spain. During the minority of Louis XIV he entered the service of Sweden. Duquesne defeated the Danish fleet near Gothenburg in 1643, was elevated to the rank of vice admiral, and, by a succession of victories over the united fleets of Denmark and Holland, forced Denmark to conclude peace. When the Spaniards prepared to support Bordeaux, which had declared itself for the party of the Fronde in 1650, he collected a squadron at his own expense and compelled Bordeaux to submit. On the revolt of Messina against the Spanish government France sent him to support the insurgents. With a small force Duquesne gallantly opposed the united fleets of Spain and Holland, commanded by De Ruyter, and in April, 1676, completely defeated his enemies off the coast of Sicily. In 1682 Duquesne cleared the Mediterranean of the Barbary pirates, and in 1684 he bombarded Genoa. Louis XIV rewarded Duquesne with the title of marquis and a considerable estate. On the revocation of the Edict of Nantes Duquesne was excepted from the general decree of banishment issued against all Protestants. Consult Plon, *Duquesne et la marine de son temps* (Paris, 1872).

**DUQUESNOY**, du'kānwā', FRANÇOIS (1594-1643). A Flemish sculptor, born in Brussels. He studied under his father, who was a sculptor, and then in Italy, where most of his work was done. The details of his life are uncertain, but he seems, after a long and hard struggle, to have made a name for himself, but scarcely a living, though he acquired the friendship of Van Dyck, Poussin, and Albano, and the patronage of Constable, Filippo Colonna, Marquis Giustiniani, and Pope Urban VIII. For the latter he modeled the groups of children for the columns of the high altar in St. Peter's, Rome, a statue of St. Andrew in the same church, and a statue of St. Susanna for Santa Maria di Loreto, Rome. Finally Cardinal Richelieu, who had heard of Duquesnoy through Poussin, invited him to the court of Louis XIII; but on his way to France the artist died at Livorno, poisoned, it is said, by his brother Jérôme.

Duquesnoy is best known for his naïvely naturalistic representations of children, and especially for his graceful and charming reliefs, of which the most popular represent children with a goat, the drunken Silenus, or Bacchus. Beautiful examples of such reliefs in ivory, in which medium Duquesnoy excelled, are in the Museum of Dresden and in the South Kensington Museum, London. The celebrated Manikin Fountain in Brussels is usually attributed to him.

**DUQUOIN'**. A city in Perry Co., Ill., 74 miles southeast of East St. Louis, on the Illinois Central Railroad (Map: Illinois, C 6). It has ironworks, planing mills, flour mills, and extensive coal mines. Under a charter of 1873 its government is vested in a mayor, elected biennially, and a unicameral council of 10 members. Pop., 1900, 4353; 1910, 5454.

**DURA DEN**, dōō-rā dēn. A small glen between Cupar and St. Andrews, in Fifeshire, Scotland, through which runs a tributary of the Eden, geologically famous on account of the numerous and beautifully preserved fossil fish entombed in its yellow sandstone.

**DURA MATER**. See NERVOUS SYSTEM.

**DURAMEN** (Lat., hardness, from *durus*, hard). A term applied by botanists to the inner, more solid, and usually darker heartwood of conifers and dicotyledons. The dark-colored duramen of some trees, of which a good example is the ebony, is of considerable importance in cabinetmaking, while the light-colored sapwood or "alburnum" of these same trees is of little value. See WOOD.

**DURÁN**, dōō-rān'. AGUSTÍN (1789-1862). A Spanish poet and critic, born in Madrid. After a prolonged course of profound studies in the humanities, he was educated for the law in the University of Seville and admitted as an advocate. In 1834, during the parlous times of the regency of Queen Christina and the outbreak of the first Carlist War, he was secretary of the board for the censorship of the press, and soon afterward had a place in the National Library, of which he became director in 1854, retiring in 1855 to devote himself to his literary work. Despite his poetic ability as shown by his poem *Leyenda de las tres toronjas del verjel de amor* (1856) he is best remembered as a creative, or constructive, literary critic. In 1828 he published anonymously a *Discurso sobre el influjo que ha tenido la critica moderna en la decadencia del teatro antiguo*, a treatise which greatly influenced the younger dramatists of the period. He did also a great deal of very valuable work for the collection and preservation of the ballad literature of Spain, of which he published 5 vols. (1828-32), which were republished, with important additions and notes, in 2 vols. (*Biblioteca de autores españoles*, vols. x and xvi, Madrid, 1849-51). In 1839 he was elected a member of the Real Academia Española, and his name appears in its official *Catálogo de autoridades de la lengua*.

**DURAN**, du'rān', CHARLES AUGUSTE EMILE DURAND, usually called CAROLUS-DURAN (1838- ). A French portrait painter. He was born at Lille, July 4, 1838, and studied under Souichon at the Lille Academy of Art and afterward at the Ecole Suisse in Paris, where he devoted himself chiefly to copying the old masters in the Louvre, especially Leonardo and Velasquez. In 1861 he obtained the Vicar prize for painting and went to Italy and Spain, continuing his

study of Velazquez, who remained his chief model. While at the monastery of St. Francis near Subiaco, during his stay in Rome, he painted his first important work, "The Evening Prayer" (1863). This was followed by "The Assassination" (1866, in the Lille Museum), a picture which shows much dramatic power. After his journey to Spain he turned his attention to portraiture and exhibited "The Lady with the Glove" (1869), a full-length portrait of his wife in outdoor costume, one of his best works and now in the Luxembourg. This was followed by a series of brilliant portraits. In 1873 he opened an atelier, and many Americans sought his instruction. Among his pupils were Low, Sargent, and Beekwith. His portraits are usually of women and children. They are essentially modern, lifelike, and boldly painted. But while his early pictures show great strength and nobility of color and admirable handling of drapery, in later years his art declined. In technique Duran has rarely been surpassed, but in interpretation of personality his great pupil, Sargent, goes beyond him, and Duran never nearly equals his chosen master, Velazquez, in subtlety of expression. His other works include portraits of Monsieur Edouard R. and Madame Feydeau; "Lady with a Dog" (Lille Museum); "At the Seaside"; an equestrian portrait of the actress Mademoiselle Croizette; "Bettina," very much like Velazquez in treatment; the Countess of Vandal; Madame de Pourtalès, Emile de Girardin, Gustave Doré, Gounod, Pasteur, and the painter Français (1900), now in the Luxembourg. He also painted landscapes, such as "Evening on the Loire" in the Luxembourg, and a series of historical and genre subjects, in which the influence of Veronese and Rubens is apparent. Among these are the "Bathers"; the "Gloria Mariæ Medici," a decorative composition for a ceiling in the Louvre; the "Burial of Christ" (1882); "Dawn"; and the "Vision." He received the medal of honor in 1879. In 1890 he helped to found the Société Nationale des Beaux-Arts, and in 1900 he was made president of this association and grand officer of the Legion of Honor. At St. Louis in 1904 he exhibited a portrait of Madame Jaques Stern, "Christ's Last Hour," and "A Thunder Storm." In 1905 he was named member of the Institute and director of the French Academy at Rome. Consult Muther, *History of Modern Painting* (New York, 1907), and his biography by Alexandre (Paris, 1902).

**DURANCE**, du'rāns'. A river in the south-eastern part of France, rising in the Department of Hautes-Alpes near the base of Mont Genève (Map: France, S., L 4). It flows through the Department of Basses-Alpes in a southerly direction, then, curving westward, proceeds towards the Rhône, crossing the boundary between the departments of Hautes-Alpes and Bouches-du-Rhône, and joins the Rhône about 3 miles below Avignon. Its total course is about 225 miles—no part of which is navigable. It supplies Marseilles with water by an aqueduct, 51 miles in length, and irrigates an otherwise arid region.

**DURAND**, du'rān', ALICE MARIE CÉLESTE. See GRÉVILLE, HENRY.

**DURAND**, ASHER BROWN (1796-1886). An American painter and engraver, born at South Orange, N. J. In early life he was apprenticed to the engraver Maverick, with whom he later entered into partnership. Two of his well-known plates are those after Trumbull's "Declaration

of Independence," and "Ariadne," after Vanderlyn. They are clear and strong in line and faithful in the reproduction of his models. In 1835 he began as a portrait painter. His subjects included General Jackson, Henry Clay, and heads of all the presidents, done from nature or copied. In figure pieces, such as "The Wrath of Peter Stuyvesant" (New York Historical Society), he was less successful. From 1841 until his death he devoted himself principally to landscape painting, and with Thomas Cole founded the American landscape school. His landscapes are really large sketches or studies, painted directly from nature, which was unusual in his day. They are somewhat imperfect in composition and hard in color, but good in line and interesting in detail. His "Mountain Forest" (1869) is in the Corcoran Gallery at Washington, and the Metropolitan Museum possesses four of his works, including "In the Woods," one of his best landscapes. Another good example is in the New York Public Library. He was one of the original members and president of the National Academy of Design (1845-61). Consult his biography by John Durand (New York, 1894), and Isham, *The History of American Painting* (ib., 1905).

**DURAND**, E(DWARD) DANA (1871- ). An American statistician, born at Romeo, Mich., and educated at Oberlin College, where he graduated in 1893, and at Cornell. Between 1895 and 1902 he was legislative librarian of the New York State Library, assistant professor of administration and finance at Leland Stanford Junior University, instructor in economics at Harvard University, secretary of the United States Industrial Commission, and special expert on street railways and electric-light plants for the United States Census Office. He was special examiner for the Bureau of Corporations (1903-07); deputy corporation commissioner (1907-09); director of the Census to 1913, and afterward professor of statistics at the University of Minnesota. In 1910 he was elected a vice president of the American Statistical Association. Besides contributions to economic journals, he is author of *Finances of New York City* (1898).

**DURAND**, ELIAS (1794-1873). An American botanist, born at Mainz, Germany. He pursued medical studies and became a member of the medical corps of the French army. Upon the fall of the First Empire he emigrated to the United States and set up a drug store in Philadelphia. He collected an herbarium which included no less than 10,000 species of North American flora, and which he presented to the Museum of the Jardin des Plantes, Paris, where a special gallery was assigned to it.

**DURAND**, WILLIAM FREDERICK (1859- ). An American marine engineer, born at Bethany, Conn. He graduated at the United States Naval Academy in 1880 and was a member of the United States Naval Engineer Corps in 1880-87 and professor of mechanical engineering in the Agricultural and Mechanical College of Michigan in 1887-91. In 1891 he became professor of marine engineering in Cornell University, and in 1904 he went to Leland Stanford Junior University as professor of mechanical engineering. Besides contributions to engineering journals, he published: *Fundamental Principles of Mechanics* (1889); *The Resistance and Propulsion of Ships* (1898); *Practical Marine Engineering* (1901); *Motor Boats* (1907).

**DURANDANA**, dōō'rān-dā'nā, also DURAN-

DAL, DURENDA, DUBINDANA. Roland's sword, which he broke in two on the day of his death, lest it should fall into cowardly hands.

**DURANDARTE**, dūr'ān-dār'tā. A traditional Spanish hero, killed in the battle of Roncesvalles. He is mentioned in the old ballads and appears in *Don Quixote*.

**DURAND-CLAYE**, dūr'ān'klā', ALFRED AUGUSTIN (1841-88). A French engineer. He was born in Paris, where he was chief engineer of the Department of Public Sanitation and professor of hydraulic agriculture at the Ecole Nationale des Ponts et Chaussées and at the Ecole des Beaux-Arts. He subsequently became inspector general of roads and bridges. The following are his more important works: "Stabilité des voûtes en maçonnerie," in the *Annales des Ponts et Chaussées* (1867), a work which was extensively used in engineering schools; *Stabilité des arcs métalliques* (1868); *Assainissement de Bruxelles* (1870); *Pompes centrifuges* (1873); *Lac Fucino* (1878); *Assainissement de Paris* (1884); *Cours d'hydraulique agricole* (1890).

**DURANDUS**, GULIELMUS, also known as GUILLAUME DURAND, DURANTI, or DURANTIS (1237-96). A Roman Catholic prelate and jurist, surnamed the Speculator. He was born at Puimisson, near Béziers, and was educated at Bologna. After teaching canon law at Modena and occupying several important offices in the papal service at Rome, he was appointed Bishop of Mende in Languedoc (1286), whence he was recalled to Italy in 1295 by Pope Boniface VIII, who appointed him Governor of Romagna. A splendid tomb was erected to his memory in the Dominican church of Santa Maria sopra Minerva at Rome. The principal work of Durandus is the *Speculum Judiciale* (c.1271), a complete system of practical jurisprudence, comprising for the first time all the Roman and ecclesiastical laws. The work is based upon a careful study of the legislative texts, the jurisprudence, and the commentaries of previous investigators, and is valuable both from a theoretical and a practical point of view. More than 40 editions of it have been published, the best being that of 1612. The liturgical work of Durandus, *Rationale Divinorum Officiorum*, was translated into English by J. M. Neale and B. Webb under the title *The Symbolism of Churches and Church Ornaments* (1843; 3d ed., 1906). As the *Speculum* was basic in its influence upon the development of legal procedure, so the *Rationale* may be accepted as the standard work on the liturgy of the Roman Catholic church. It was published at Mainz in 1459 and is one of the first specimens of the art of printing.

**DURANGO**, dūr'ān'gō (known also as Ciudad de Victoria and formerly as Guadiana). A city, the capital of the State of Durango, Mexico, 480 miles north by west of Mexico City, on the Funal River and on the Mexican International Railway (Map: Mexico, G 5). It is situated 1927 meters (6321 feet) above sea level, in a valley near the famous iron-ore hill, Cerro del Mercado. The city is an episcopal see and contains a handsome cathedral. Other imposing buildings include the government palace, city hall, theatre, and hospital. It formerly had a mint, which dated from 1811 and coined annually gold and silver to the amount of about \$1,000,000. There are a college, formerly controlled by the Jesuits, an episcopal seminary, a public library, a penitentiary,

and a bull ring. The city is lighted by electricity, and has street railways and telephone service. Durango is in an agricultural and stock-raising district and is an important mining centre; it has also cotton and woolen mills, flour mills, sugar-cane mills, foundries, and a large tobacco factory. It is the leading commercial city of the state. There are thermal and mineral springs in the vicinity. Durango was founded about 1560 by Alonzo de Pacheco. It was the capital of the Province of Nueva Vizcaya, which included (until 1823) Durango and Chihuahua. Pop., 1895, 26,428; 1900, 31,092; 1910, 34,085.

**DURANGO**. An inland state of Mexico, bounded on the north by Chihuahua, on the east and southeast by Coahuila and Zacatecas, and on the west and southwest by Sinaloa and touching Tepic on the south (Map: Mexico, F and G 5). Area, 38,009 square miles. Durango is a high, semiarid plateau, with the Madre traversing its western side. There are no large rivers in the state. The soil of the plateau is generally of good quality and with irrigation could be made productive. Wheat and vegetables are successfully cultivated in some districts, and sugar cane and cotton in the valleys. Some corn, tobacco, and grapes are also produced. The climate is dry and healthful, but hot on the western slope of the Sierra. In the mountain valleys stock-raising is an important industry. Durango's principal source of wealth is mining, and the region has been famous since colonial times for its output of silver. Some of the ore assays very high, that of the Candelaria Mine between \$70 and \$140 a ton. This mine, in the San Dimas District, west of the Sierra, is said to have produced over \$100,000,000 before the end of the nineteenth century. In the fiscal year 1911-12 the silver output of the state destined for exportation was 120,657.6 kilos, valued at 4,369,167 pesos. The gold output was 859,928 grams, valued at 1,146,528 pesos. Copper, iron, cinnabar, zinc, and lead occur; but the mining of base metals has not been extensively developed on account of inadequate transportation facilities. A short distance south of Durango City is the Cerro del Mercado, a hill of high grade iron ore estimated to contain several hundred million tons of the metal. The hill is about 640 feet high (above the surrounding country), 1100 feet broad, and 4800 feet long. In its vicinity are iron and steel works. The mines are controlled chiefly by American capital. Manufacturing has made some progress since 1900; there are soap and candle factories, tanneries, pottery works, etc. At the end of the fiscal year 1912 six cotton mills were in operation; their consumption was 490,182 kilos, and the value of their output 599,153 pesos. The state is crossed by the Mexican Central (in the east) and Mexican International railways. Pop., 1895, 292,549; 1900, 370,294; 1910, 483,175. The inhabitants are largely of Indian blood. Of the total in 1910, 88,358 could read and write, 7615 read only, and 224,313 of 12 years and over were illiterate. The population is almost entirely Roman Catholic, 480,328 being returned as of that faith in 1910. The state has only six towns with over 4000 inhabitants: the capital, Durango (34,085); Gómez Palacio (15,997); Ciudad Lerdo (8609); Mapimi (8204); Velardeña (5939); and Ojuela (5086).

**DURANGO.** A city and the county seat of La Plata Co., Colo., about 300 miles (direct) west by south of Pueblo, on the Las Animas River, and on the Denver and Rio Grande and the Rio Grande Southern railroads (Map: Colorado, B 4). The city has a Carnegie library and municipal water works. It is the commercial centre for southwestern Colorado and northwestern New Mexico, a region devoted to lead, gold, and silver mining, stock raising, and agriculture. Durango has smelting and reduction works, flouring mills, a packing plant, foundries, and extensive coal and coke interests. The commission form of government was adopted in April, 1913. Pop., 1900, 3317; 1910, 4686.

**DURANT.** A town and the county seat of Bryan Co., Okla., 20 miles north by east of Denison, Tex., on the Missouri, Oklahoma, and Gulf, the Missouri, Kansas, and Texas, and the St. Louis and San Francisco railroads (Map: Oklahoma, E 5). Among its institutions is a Presbyterian college and the Southeastern State Normal school. The chief industry is agriculture, cotton, corn, and berries being the principal products. There are also flour and oil mills. Under a charter of 1904 its government is vested in a mayor and a unicameral council of six members. The water works and electric-lighting plant are owned by the municipality. Pop., 1900, 4510; 1910, 5330.

**DURANT, HENRY FOWLE** (originally Henry Welles Smith) (1822-81). An American lawyer and philanthropist, born at Hanover, N. H. He graduated at Harvard in 1841, studied law, and subsequently built up a profitable practice in Boston. After a conversion to the evangelical view of religion, which drew widespread attention, he was from 1864 to 1875 a lay preacher in Massachusetts and New Hampshire. He is best known, however, as the founder of Wellesley College (q.v.), to which he contributed between one and two millions of dollars.

**DURANTE, dŭ-răn'tă, FRANCESCO** (1684-1755). An Italian composer, one of the founders of the Neapolitan school of music. He was chapelmaster in Naples, and in 1742 was at the head of the Conservatorio Santa Maria di Loreto in that city. He had great fame as a teacher. Among his pupils were Duni, Jommelli, Piccini, Pergolesi, Sacchini, and Paisiello. Under Durante the Neapolitan school reached the climax of its celebrity, and it was in this school that the great traditions of Italian vocal art were established. As a composer, he adhered to the severe style of the early Italian masters.

**DURANTIS, dŭ-răn'tēs', GULIELMUS.** See DURANDUS, GULIELMUS.

**DURÃO, dŭ-roun'.** JOSÉ DA SANTA RITTA. See SANTA RITTA DURÃO.

**DURAS, dŭ-rās', CLAIRE LECHAT DE KERSAINT, DUCHESSE OF** (1777-1828). A French novelist, whose *Ouïka* (1823) and *Edouard* (1825) represent the best phase of the culture of the Restoration and foreshadow the socialistic fiction of George Sand (q.v.). Consult A. Bar-doux, *Mme. de Duras* (Paris, 1898).

**DURATION** (ML. *duratio*, from Lat. *durare*, to last), or PERSISTENCE IN TIME. The simplest temporal determination of mental processes. It may be assumed that every simple conscious process and every state of consciousness has a normal duration, varying with variation of circumstances, but still capable of numerical statement. The ascertainment of this normal

duration is of importance to an exact psychology, and a good deal of work has accordingly been done upon it. Unfortunately the complication of factors is so great, even in the most favorable case—that of sensation—that the results so far obtained must be taken with reserve. Suppose, e.g., that we try to determine the duration of pressure sensation by applying an intermittent stimulation at a chosen point of the cutaneous surface and noting the rapidity at which the stimuli may follow one another without giving rise to a single continuous pressure. If we mark the point at which the stimuli are still just sufficiently separated to give a rough, thrilling perception, we shall say that the skin can discriminate pressures of  $\frac{1}{10}$  of a second's duration and under. If, on the other hand, we demand that the pressure sensations be full and clear, we shall put their duration as high as  $\frac{1}{10}$  or  $\frac{1}{10}$  of a second. And these two values will vary, further, with the intensity of the applied stimuli. In the sphere of vision the duration of sensation depends partly upon the intensity of stimulus, partly upon the character of the visual interval which separates the given sensations. Külpe estimates it, omitting the negative after-image (see AFTER-IMAGES), at  $\frac{1}{10}$  of a second. Temperature sensations last, on the average, about half a second. The times required for the cognition of tones vary considerably with practice. Maximal practice presupposed, they lie apparently between one and two vibrations and thus decrease with increase of the pitch number of the stimulus. Thus, a tone of 64 vibrations must be sounded for  $\frac{1}{10}$  of a second, while a tone of 187 vibrations can be cognized in  $\frac{1}{10}$  of a second. There is, however, a point upon the scale at which the duration of stimulus necessary to the cognition of a tonal quality sinks to an absolute minimum. This point lies at the G of 3168 vibrations in the second, which can be heard if the tone sound only for  $\frac{1}{10000}$  of a second. (For the duration of a pulse or wave of attention, see ATTENTION.) No investigation of affective durations has as yet been undertaken.

Psychologists have also made a study of duration as such—i.e., of our capacity to perceive and to compare empty time intervals. Thus, two electric sparks seen in daylight are clearly differentiated if the time between them amount to  $\frac{1}{10}$  of a second; the snaps of two sparks are heard as separate, under favorable conditions, if the interval be as small as  $\frac{1}{100}$  of a second. When the impressions belong to two different sense departments (touch-hearing, touch-sight, sight-hearing), the just noticeable interval varies with the order in which they come (touch-hearing or hearing-touch) and with the direction of attention; the values most frequently obtained fall within the limits  $\frac{1}{10}$  and  $\frac{1}{10}$  of a second. It need hardly be said that the judgment in these cases is a judgment simply of the separateness of the two sensations, and that the attention is directed upon the stimuli themselves and not upon the length of the time interval between them.

Our appreciation of the relative duration of short intervals—i.e., our judgment as to whether a given interval is longer or shorter than another—is somewhat astonishingly accurate. For psychological purposes intervals fall into three groups: (1) "short" times, ranging from the just noticeable duration to about 0.5 or 0.6 of a second; (2) "moderate"



times, extending from this latter value to 3 or 4 seconds; and (3) "large" times, from 4 seconds upward. In the case of (1) our temporal estimation is direct; the impressions which limit the intervals (sharp sounds) are all in consciousness together; we do not compare the intervals, but judge simply of the rapidity or rate of succession of the limiting stimuli. Our estimation is therefore strongly influenced by intensity, and duration of these limiting impressions, as well as by their rhythmical form, by the direction of attention, etc. With maximal practice and under favorable conditions, an interval of 0.3 second may be discriminated from an immediately following interval of 0.303 second. In the case of (2) and (3) the temporal estimation is indirect. Large times are judged predominantly in terms, not of time, but of its contents: the greater the number of ideas, perceptions, or feelings in the interval, the longer is the interval estimated to be. Moderate times seem to furnish the material of true temporal comparison. The first limiting impression of the first interval is just disappearing from consciousness as the first impression of the second interval enters. The former impression is then reproduced; a definite direction is given to the strain of attention, and the closing impression of the second interval is "expected" at a moment corresponding to that at which the first interval closed. The basis of judgment is thus given by strain and other organic sensations, with their accompanying feelings.

The work so far accomplished upon the course of temporal discrimination is incomplete, and the laws upon which it rests demand further confirmation. It appears, however, that there is constancy of the relative differential sensitivity (see DISCRIMINATION, SENSIBLE) over a certain range of short and moderate times; that short intervals are overestimated and longer intervals underestimated; and that this error of estimation has the zero value at an interval of 0.5 or 0.6 second (indifference point of temporal discrimination). See BERGSON, HENRI.

Consult: Külpe, *Outlines of Psychology* (London, 1901); Wundt, *Grundzüge der physiologischen Psychologie* (Leipzig, 1908-11); Meumann, in *Philosophische Studien*, viii (ib., 1893); Weyer, in *Philosophische Studien*, ix (ib., 1894); Stern, *Psychologie der Veränderungen* (Breslau, 1898); Titchener, *Experimental Psychology*, II, ii (1905).

**DURATION.** In plants, the length of the vegetative period. One of the chief ecological classifications is based on the duration of the various plants or their organs. Perhaps the most important classification of this kind is that into monocyclic, dicyclic, and pleiocyclic plants, or, as they are more popularly called, annuals, biennials, and perennials. Whether or not these types may be regarded as the product of certain ecological conditions, it is certain that they are often associated with particular environments. Annuals and biennials, e.g., are most common in new habitats, as in gardens allowed to run wild, and after fires, or in xerophytic situations, as on shores and deserts. Perennials, on the other hand, comprise most of the world's vegetation and dominate particularly in habitats that are ecologically rich or that have been long established. It seems, therefore, that the perennial habit is, on the

whole, the most successful, and it is not difficult to see why, since perennials commonly spread vegetatively as well as by seed. Each year, therefore, the perennials are on the ground at the beginning of the season, while annuals and biennials are obliged to start from seed. A garden patch allowed to run wild shows, as a consequence, fewer and fewer annuals and more and more perennials each year until finally the annuals are gone. In desert regions and along shores the vegetation is sparse, and annuals or biennials may exist almost indefinitely. Annuals are scarce in Alpine and Arctic regions, perhaps because the vegetation periods are too short for their development.

Another important classification based on duration is that into deciduous and evergreen forms; in these plants, however, the critical point is not fully expressed when these terms are employed. Deciduous forms may be defined as plants which shed their organs, and especially leaves, regularly; whereas evergreens are those plants which shed their leaves irregularly. Evergreen leaves are much longer lived than deciduous leaves. The significance of these types will be discussed under the head of FOREST (q.v.). The duration of stems depends largely on their structural nature; in temperate climates most aerial herbaceous stems are annual, whereas woody stems are perennial. Flowers, in contrast to other organs, have an ephemeral duration. There seems thus to be a harmonious relation between duration and structure, organs with long life having resistant structures, while short-lived organs are commonly delicate. See FOREST; STEM; VEGETATIVE PROPAGATION; BIENNIAL; ANNUAL; PERENNIAL.

**DURAZZO**, dōō-rāt'sō (Turk. *Drasch*, Slav. *Drach*, Albanian *Duressi*, from Lat. *Dyrrhachium*, from Gk. Δυρράχιον, from *δυσ*, *dys*, bad + *ῥαγνύναι*, *rhēgnynai*, to break, in allusion to the surf on the peninsula). A decayed maritime town in the Principality of Albania, built on the rocky peninsula of Pelu, in the Adriatic, about 55 miles south of Scutari (Map: Turkey in Europe, B 4). It is surrounded by dilapidated old walls. The town has been the seat of a Catholic archbishop since the days of Justinian. The once fine harbor has been silted up. Durazzo exports to Austria-Hungary olive oil, wool, raw silk, and some grain. Under the Turks the population fell as low as 1200; it is now over 5000.

Durazzo is the ancient Epidamnus, which was founded 625 B.C. by a band of Corcyraeans and Corinthians. Owing to its position on a fine bay, an inlet of the Adriatic Sea, and to the fertile country about it, Epidamnus became a great and populous city, but was much harassed by internal party strifes; the banishment of its aristocratic element in 436 B.C., and the consequent dispute regarding authority between Corcyra and Corinth constituted one of the causes of the Peloponnesian War. It passed to the Romans in 229 B.C. To them the name Epidamnus suggested the noun *damnum*, 'loss,' so that it seemed to signify "Lossville," or the like; hence they employed rather the other name of the city Dyrrhachium. (See Pliny, *Historia Naturalis*, iii, 145; Plautus, *Menæchmi*, 264-265.) It later became the seat of a Roman colony and the regular landing place for those journeying to Greece. (See BRINDISI.) Dyrrhachium was the starting point of the impor-



tant Via Egnatia, a main highway leading to Byzantium and to Asia. Here Pompey was for some time beleaguered by Cæsar; extensive swamps about the city made it easy to defend. About the end of the fourth century it became the capital of the Byzantine Eparchy of New Epirus. The town was taken by the Ostrogoths, Bulgarians, and Normans, and in the latter part of the Middle Ages belonged successively to the house of Anjou (then ruling in Naples) and to Venice, from which it was wrested by the Turks in 1501. See the article "Dyrrachion" (illustrated), in Pauly-Wissowa, *Real-Encyclopædie der klassischen Altertumswissenschaft*, vol. v (Stuttgart, 1905). For four centuries Durazzo remained under Turkish rule as a part of the Vilayet of Scutari; it steadily declined and seemed to lose all importance. The Balkan War of 1912-13 (q.v.), however, brought the ancient town once more into prominence. From the outset of the struggle the Servians made Durazzo the objective of a proposed extension of their kingdom to the Adriatic, and on Nov. 28, 1912, they occupied the town. The determination of Austria-Hungary and Italy to prevent Servia from securing an outlet on the Adriatic led to grave international complications, which were ended only by the withdrawal of the Servians early in 1913 and the incorporation of Durazzo in the newly erected Principality of Albania. Until the arrival in the country of William of Wied, the first prince of the new state, in 1914, Durazzo was the seat of the provisional government of Essad Pasha.

**DURBAN**, dər'bān. A seaport town of British South Africa. See PORT NATAL.

**DURBAR**, dər'bār (Pers. *darbār*, audience). A Hindustani word signifying a court or place of judgment in which are decided, or from which are promulgated, matters of importance to the state. In India, Afghanistan, and in parts of Persia, it is customary for rulers, governors, or chiefs to give audience to distinguished visitors in "darbar" as well as to ratify treaties or make important agreements. The British Viceroy and all other British governors in India follow the native custom, in accordance with which Queen Victoria was proclaimed Empress at a magnificent darbar held on the ridge at Delhi in 1877, and King Edward VII as Emperor in 1902. The term "darbar" is applied also to the room or place of audience.

**DURBIN**, JOHN PRICE (1800-76). An American clergyman, born in Bourbon Co., Ky. At 20 years of age he entered the Methodist ministry, but while preaching pursued a course of study, part of the time attending Miami University and in 1825 graduating from Cincinnati College. He was chaplain of the United States Senate in 1831, for two years was professor of languages in Augusta College, Kentucky, edited *The Christian Advocate and Journal* of New York (1832-33), and from 1834 to 1842 was president of Dickinson College. The year 1843 he spent in travel abroad. Much of the success of the Missionary Society of the Methodist Episcopal church is due to his efforts while secretary in 1850-72. Next to Bishop Matthew Simpson, he was considered the most eloquent man of his generation in the denomination. He published *Observations in Europe, principally in France and Great Britain* (2 vols., 1844) and *Observations in the East, chiefly in Palestine, Syria, Egypt, and Asia*

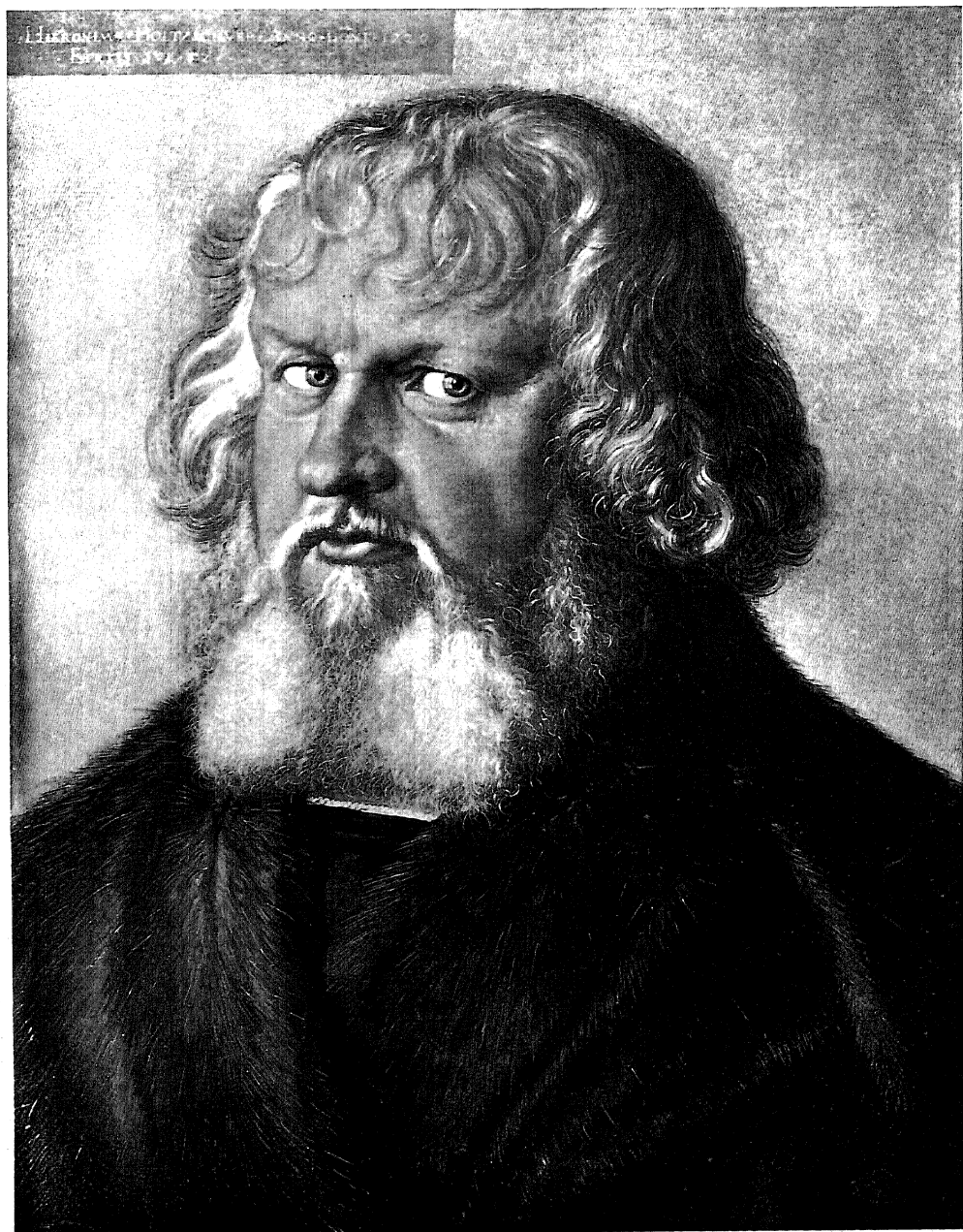
*Minor* (2 vols., 1845); and he edited Wood's *Mosaic History of Creation and The Short Sermons* of Jonathan Edmondson. Consult Roche, *The Life of John Price Durbin* (New York, 1889).

**DURCHMUSTERUNG**. See ASTROPHOTOGRAPHY.

**DUR'DEN, DAME**. The name of a conscientious housewife in a well-known old English ballad and hence applied as an affectionate nickname to Esther Summerson in Dickens's *Bleak House*.

**DÜREN**, dü'ren. An ancient town of Rhenish Prussia, situated on the Roer, 18 miles east of Aix-la-Chapelle (Map: Prussia, B 3). Its Gothic church of St. Anna, containing relics of the saint, attracts many visitors. In the museum, built 1905, are collections of antiquities, natural history, and painting, and a public library. The town hall has a fine assembly room. The town manufactures paper, sugar, cloth, wool, cotton, and flat goods, linen, carpets, castings, needles, machinery, and beer. Pop., 1900, 27,171; 1905, 29,770; 1910, 32,511. Here Charlemagne, on his way to attack the Saxons, held diets in 775 and 779 A.D. Consult Schoop, *Geschichte der Stadt Düren bis 1544* (Düren, 1901), and *Beschreibung des Begreviers Düren* (Bonn, 1902).

**DÜRER**, dü'rër, ALBRECHT (1471-1528). A German painter, engraver, and designer of the Franconian school, the most prominent and influential master of the German Renaissance. He was born at Nuremberg, May 21, 1471. His father, a goldsmith, was a native of Eytas, Hungary, who had come to Nuremberg in 1455. There has been much patriotic argument whether he was German or Magyar; however this may have been, the son was thoroughly German in character and in art. His mother was Barbara Holper, a native of Nuremberg, and Dürer was the third of a family of 18 children. These facts as well as those of his early years are quaintly narrated in the introduction to the journal which he later wrote. After learning to read and write at school, the lad worked with his father at the goldsmith's trade. His early talent for design is shown in a clever drawing of himself at the age of 13, in the Albertina collection, Vienna, and in a pen drawing of the "Madonna with Two Angels" (1485), in the Museum of Berlin. Yielding to his son's desires, his father in 1486 apprenticed him to the painter Wohlgemuth, with whom he studied three years. After Easter, 1490, the young artist began his "Wanderjahre" (the years spent in travel by a German journeyman before he became a master). His journal does not tell us whether his footsteps led him, but we know from other sources that he worked at Colmar (Alsace), in the atelier of Martin Schongauer, who had died shortly before his arrival. He afterward was occupied with wood engraving at Basel, as is known from his signature on certain blocks which still survive, and he probably was at Strassburg in 1494. He appears also to have visited Venice, to judge from the Italian influence in his work and from an expression in a letter written 11 years later. After the customary absence of four years he returned to Nuremberg and married Agnes Frey, the daughter of a cultured merchant. She was probably a good wife, and not the Xantippe she was reputed to be, thanks to the picnic of Dürer's



ALBERT DÜRER

PORTRAIT OF "HIERONYMUS HOLZSCHUHER," FROM THE PAINTING IN THE NATIONAL GALLERY, BERLIN



friend Pirkheimer. In 1497 Dürer opened a studio of his own at Nuremberg and figured thenceforth as an independent master.

The work executed up to the time of his visit to Venice, in 1505, belongs to his first period. His early work shows little influence of Wohlgenuth, but much of Schongauer and Mantegna, and some by Jacopo de' Barbari, a Venetian artist then residing in Nuremberg, who taught him anatomy and ideal proportions. It consisted chiefly of engraving: that wonderful series of woodcuts, the "Apocalypse," so typical of the restless spirit of the age and full of the bold geniality of youth; the greater number of blocks for "The Large Passion" series; and most of "The Life of Mary." He also began his work in line . . . . . at first after Italian models, but gradually becoming independent. His religious paintings were chiefly altarpieces, designed by himself, but to some extent executed by his pupils, according to the custom of German painters of the day. The earliest is in the Dresden Gallery and represents the "Virgin Adoring the Sleeping Christ Child." Another, the Baumgarten altar (Munich), depicts in the central panel the "Nativity," in the wings the figures of two "donors" in knightly armor as Saints George and Eustachius. The recent restoration of these paintings was a remarkable triumph of the modern restorer's skill. In the central panel it resulted in the addition of the tiny figures of seven small donors; in the wings the horses, breastplates and helmets of the knights, together with forest backgrounds, were removed. The best of the religious subjects is the "Adoration of the Magi," painted in 1504 for Frederick the Wise, Elector of Saxony, but now in the Uffizi Gallery at Florence. It is well composed, and enriched by charming landscape, with good perspective. The Virgin is fair-haired and German, and the kings are dignified and well-modeled figures, with fine heads.

The portraits of this period were executed without the assistance of his pupils and are powerful and characteristic. There are two interesting portraits of Dürer's father—one in the Uffizi, executed before his "Wanderjahre," in 1490, and the other in the National Gallery, London, done in 1497. Among the very best of his portraits are two of himself. That of 1498, of which the original is in Madrid (the Florence example being a copy), shows a faultlessly attired youth of noble features, with long fair hair, and having the noble bearing for which he was celebrated. In the more mature, full-face portrait dated 1500 (Munich), the beautiful ringlets are even more luxuriant, and the head is Christlike in its refinement and dignity. According to Wölfflin both the signature and date (1500) are forgeries, the real date being about 1506. Among his other portraits of this period are Frederick the Wise of Saxony (Berlin), two of "Katharine Fürleger" (Frankfurt), of Hans Tucher and his wife (1499, Weimar), of Oswald Krell (1499, Munich), and the so-called Hans Dürer (1500, Munich).

The Venetian journey of 1505 caused a change in Dürer's art. Before this time his work was angular and stiff, like that of the German school. The study of the antique and of the works of Venetian masters refined his sense of form and gave him a larger view of art, but he never lost his individuality. He was especially influenced by Giovanni Bellini, whom he considered the

greatest of painters and who proved a good friend. The other Venetian painters viewed him with curiosity and envy, but the nobility honored him, and before he left Venice the Venetian Council offered him an annual pension of 200 ducats to remain. He also visited Bologna and Ferrara, and was on the way to Padua to see Mantegna, whom he much honored, but turned back on news of the death of that master, arriving at Nuremberg late in 1507.

Modern research has shown that the real cause of Dürer's visit to Venice was a commission from the German merchants of Venice to paint a large altarpiece for their chapel in San Bartolommeo. This picture, long in Strahow Abbey, Prague, is now in the Rudolphinum of that city. It has been much damaged by restoration, but even now we can see that it must have been wonderful in composition and color. Its subject is the "Feast of the Rose Garlands," and it represents the Virgin and the Christ Child giving wreaths of roses to the Emperor Maximilian and to Pope Julius II, while St. Dominic and angels do the like to the bystanders. His "Christ Disputing with the Doctors" (1506), now in the Barberini Palace, Rome, was executed, as the inscription records, in the space of five days and is an unsatisfactory collection of heads and hands, most of them caricatures. Among his other . . . . . are the "Martyrdom of the . . . . ." (1508), a very overcrowded composition, now in the Vienna Museum, and the Heller altarpiece, of which the original was destroyed. The "Adoration of the Trinity" (1511), in the Museum of Vienna, is admirable in color and in sentiment and contains a good portrait of the painter.

Among his other works of the second period are a small "Christ on the Cross" (1506, Dresden), exquisite in execution and sentiment; the "Madonna with the Finch" (1506, Berlin); and a "Madonna with the Pear" (1512, Munich). His "Adam and Eve" (1507) in Madrid (the Florence examples being copied or replicas), shows what he learned in Italy as to treatment of the nude. It is somewhat idealized, not a copy of the model, as was customary in Germany. His heads of the apostles James and Philip (1516, Uffizi) are of great strength, and his "Lucretia" (1518, Munich), a nude, is one of his few mythological subjects. Among his portraits are those of unidentified young men (at Vienna and at Hampton Court), probably German merchants of Venice, and another of a young woman, erroneously called Dürer's wife, at Berlin, all dating from 1506. The well-known but poorly executed "Charles the Great," with crown and sceptre, and "Emperor Sigismund" (both in the Germanic Museum, Nuremberg), date from 1512. He continued his work in engraving—designing the "Little Passion" in wood and engraving the same subject on copper. This was also the period of his so-called "Master Prints" in line engraving, his "Triumphal Arch," and the wonderful drawings of the "Emperor's Prayer Book."

In the summer of 1520 Dürer, accompanied by his wife and servant, made a journey to the Netherlands which lasted over a year. His object was to meet the new Emperor, Charles V, when he landed at Antwerp, in order to obtain a renewal of the pension which he had enjoyed under Maximilian. He has left us an interesting journal of his journey, and he also kept a sketchbook, many of the leaves of which sur-

vive. He was received everywhere with great honor, especially by the painters of Flanders, whose guilds vied with one another in homage to the illustrious stranger. Antwerp offered him a pension of 300 florins, a house, and freedom from taxation, to remain; but his patriotism forbade.

Margaret of Parma, Regent of the Netherlands, received him with honor, and he painted a portrait of the King of Denmark. He was present at the Emperor's coronation at Aix-la-Chapelle, where his pension was renewed. But the most important result of his memorable journey was the influence of the early Flemish painters, especially that of the brothers Van Eyck in the Ghent altarpiece, upon his own painting, which now attained that excellence of color it had hitherto lacked. The last period, that of his greatest paintings, begins at this point. From 1521 date the portraits of Barend van Orley (Dresden Gallery), "An Unknown Man" (Boston Museum), and the banker Hans Imhof (Madrid)—from a purely technical point of view the best of his portraits—as well as "St. Jerome" (Lisbon Museum). In 1526 he completed the portrait of the Nuremberg councilors Johannes Kleeberger (Munich), Jacob Muffel, and Hieronymus Holzschuher, both in Berlin. The last two—Dürer's intimate friends—represent types of the thoughtful and the sanguine temperament. The "Holzschuher" has well been called "the pearl of all Dürer's portraits." (See Plate.) The head is of wonderful strength and character, and the difficult color scheme is skillfully handled; the hair is perfectly white, while the eyes are blue, the face ruddy, and the background bluish gray. The year 1526 also saw the completion of his "Four Apostles" (sometimes called the "Four Temperaments"), composed of two panels of lifesize figures of the Apostles John and Peter, Mark and Paul—Dürer's legacy to his native town. For years they remained in the council chamber of Nuremberg, until acquired, practically by force, for the Munich Gallery. They are Dürer's greatest paintings, and never did a painter's art produce stronger and more individual representations. The heads of the Apostles are dignified and sublime, the drapery is simple and majestic, and although the details are executed with great care, they do not detract from the general effect. The coloring is faultless, especially in the white and red robes of John.

Few artists have received more universal recognition than Dürer. He attended the Reichstag of Augsburg in 1518 as one of the representatives of Nuremberg and on this occasion drew the portrait of the Emperor. He was highly regarded and treasured as a friend by members of the ruling aristocracy of Nuremberg; he was associated with the greatest princes of the Empire, such as Frederick the Wise, Elector of Saxony, his earliest patron and lifelong friend; the Cardinal Archbishop of Mayence, Chancellor of the Empire; and the Emperor himself. His friendship with the chief leaders of the Reformation, Luther, Melancthon, etc., is well known. His fame extended even to Rome, where Raphael sent him drawings, requesting specimens of his own handiwork in return. He was esteemed no less for his singularly sweet and upright character than for his art. "His art, great as it was, was his least merit," said Melancthon. His piety was deep and sincere, his religious convictions profound.

A large controversial literature has arisen on the subject whether he was Catholic or Protestant. The expressions of his journal of 1520-21 certainly show the greatest admiration for Luther and approval of his doctrine, and he was also on friendly terms with the principal leaders of the Reformation. On the other hand, his message to the city council of Nuremberg, written on the back of the "Apostles," condemns the excesses of the Reformation. He died at Nuremberg, on April 15, 1528, of consumption, contracted in the Netherlands, and was buried in the churchyard of St. John. A fine monument by Rauch was erected to him in the Fischmarkt, where his house, now used as a Dürer Museum, still stands.

Most of Dürer's works are signed with his quaint monogram and are dated.

Albrecht Dürer was not only the most important, but he was the most representative, artist that Germany has ever produced. As Michelangelo in Italian art, so Dürer was the man of destiny in German art. Before him it was crude, and its technical qualities had not been perfected. He completely transformed, almost recreated it. Dürer was, above all else, a draftsman, who translated all appearances of nature into lines. He not only executed careful studies for all his pictures and for his copper engravings, but sketched and drew many subjects for their own sake. The finest collection of such drawings is in the Albertina, Vienna, which has above 100. Next to this is the British Museum, and after that Berlin. His drawings were all finished with care and exactness, and they were executed on various materials, with the pen, pencil, and brush. Sometimes they were outlined in water colors, sometimes studies on paper and parchment in body color. In the Augsburg Gallery there is a life-size Madonna in body colors; other famous examples are Dürer's "Mother" (1514, Berlin) and his wife, inscribed "Mein Agnes." He also painted a few water-color landscapes, which show fine observation and technical ability; a noted example is the "Mill" (Berlin). Among his tinted drawings are "Women Bathing" (Bremen) and "Venus with Cupid Stung by Bees" (British Museum). His famous "Green Passion" (Albertina), a series of pen and brush drawings on green paper, ranks with his best engravings. Among his best pen-and-ink drawings are the "Adoration of the Kings" (Albertina), and especially the "Prayer Book of the Emperor Maximilian" (Munich Library), in which he decorated the borders of 45 pages with drawings in red, green, and violet ink.

Dürer was easily the most prominent engraver of his day and probably the very greatest of all times. In this art his imagination, his facility and invention had room for full play. Before his day woodcuts were mere outlines, and copperplates consisted of dark figures on light backgrounds. Dürer introduced light and shade into engraving, giving it tone and thus making it pictorial. He designed more than 100 woodcuts, four great series, besides many single plates. The "Apocalypse" series (16 blocks, published 1498) shows his mastery of the art, and an extraordinary fantasy in making tangible the mystic visions of St. John. The fourth block, representing the "Four Riders of the Apocalypse," is especially good. His "Great Passion," a series of 12 plates, was produced for the most part in

1500, though published in 1511. His "Life of the Virgin," a charming series of 16 blocks, was executed chiefly in 1504-05 and published in 1511. The "Small Passion" is a series of 37 blocks, executed in his best period (1509-10). We can but wonder at the invention displayed in the different versions of the same event, as compared with the "Great Passion." The "Triumphal Arch of Maximilian," executed after 1512, was a series of 90 plates so engraved as to form a triumphal arch 10 feet high. The subjects of the different plates were laudatory of the Emperor, and of these 24 were by Dürer, including the chief subject, the "Triumphal Car," containing the Emperor and his family.

In line engraving Dürer is equally renowned. His first works are executed in the manner of Schongauer and Marietta—dark figures on a light background. Another interesting group of his copperplates is identical, except that the figures are reversed and better executed, with those of another engraver, whose signature was "W," probably Wohlgenuth. It is uncertain whether the original design was by Dürer. Among his best engravings of this group are the "Knight and Lady," the "Madonna with the Monkey," the "Dream," the "Four Witches." He soon progressed to a better manner, using a dark background. Among the prints of this description are the famous "Adam and Eve" (1504); "Christmas"; "Family of Satyrs" (1505); and the "Small Passion" (16 plates, 1512-13). Afterward he attempted etchings, but not with equal success. He presently combined both methods, first etching the plates and then going over them with the graver. These are the very best copper engravings he ever did, and in their beautiful silver tones they display the perfection of pictorial charm in an engraving. Among the best are the "Virgin Crowned by Angels," the "Virgin with the Child," and the weird "Death and the Devil" (1513), the well-known "St. Jerome in his Study" and the strange "Melancholia" (1514), the three last being known as his "Master Prints." He also engraved the portraits of celebrated contemporaries, such as the large and smaller portraits of Cardinal Albrecht of Brandenburg (1519, 1523), Frederick the Wise and Pirkheimer (1524)—his two finest portraits on copper; Melanchthon and Erasmus (1526). Many of his engravings abound in a delightful humor, like the "Three Peasants," "Love Offers," and others mentioned above, which are regarded by some as the foundation of genre in modern art. See Plate of ENGRAVING.

Dürer also occupied himself with sculpture and architecture, but none of the sculptures bearing his monogram are unquestionably genuine. The last years of his life were spent largely in literary activity, in pursuance of a patriotic design for a revival of German art, which he hoped to further by his writings.

**Bibliography.** DÜRER'S WRITINGS. The best edition of his letters, journals, and verses is by Lange and Fuhse, *Dürers schriftlicher Nachlass* (Halle, 1893); Eng. trans. of some of this material by Conway, *Literary Remains of Dürer* (Cambridge, 1889). His books on geometrical measurements and perspective, fortifications, and art, were highly esteemed and translated into Latin, French, and Italian. The most important of them is *Vier Bücher von menschlicher Proportion* (Nuremberg, fol., 1528). On his art theories, see Müller, *Die Ästhetik Albrecht Dürers* (Strassburg, 1910).

**LIFE AND WORKS.** The copious literature on Dürer has been summed up by Singer, *Versuch einer Dürer-Bibliographie* (Strassburg, 1903). All the earlier lives of Dürer were superseded by Thausing, *Dürer, Geschichte seines Lebens und seiner Kunst* (2 vols., Leipzig, 1884)—the most complete work on the subject. Of great value also are: Springer, *Albrecht Dürer* (Berlin, 1892); and Wölfflin, *Die Kunst Albrecht Dürers* (ib., 1907), the ablest and most critical work on the subject; and Weisbach, *Der Junge Dürer* (Leipzig, 1906). The biographies by Kaufman (Freiburg, 1887) and War (Paris, 1893) are controversial from the Catholic point of view; that of Zucker, in *Schriften des Vereins für Reformations Geschichte* (Halle, 1899-1900), is equally Protestant. English works are by Scott (London, 1869), Colvin (ib., 1877), Mrs. Charles Heaton (ib., 1881), Cust, in *Portfolio Series* (ib., 1897), and More (ib., 1905)—the last a very uncritical work. Consult also Nuechter, *Life and Selection from Works* (London, 1912), and Fry, *Journeys to Venice and to the Low Countries* (New York, 1912).

**REPRODUCTIONS.** Among the most important are the *Publications of the Dürer Society* (fol., London, 1898-1908), with introduction by Dodgson. Good reproductions with text are the works of Knackfuss, in *Künstler-Monographien* (Bielefeld, 1899); Scherer, in *Klassiker der Kunst* (Stuttgart, 1904); *The Masters in Art Series* (1901; 1904). Most of his drawings have been published in facsimile by Lippmann (Berlin, 1883); those of the Albertina by Schönbanner and Hader (Vienna, 1895 et seq.). See also Ephrussi, *Dürer et ses dessins* (Paris, 1882), and Colvin, *Ninety-Three Drawings of Albrecht Dürer* (London, 1898). His engravings have been published by Galichon (Paris, 1846-61) and Duplessis (ib., 1877); his copper engravings by Lübke (Nuremberg, 1876) and Leitschuh (ib., 1900).

**DURESS** (OF. *durece*, *duresce*, *duresse*, It. *durezza*, from Lat. *duritia*, severity, from *durus*, hard). That degree and kind of coercion, exercised over a person's will, which entitles him to avoid any contract, deed, or transfer of property made during its continuance, or which excuses his criminal acts.

As an excuse for crime, duress is narrowly limited by the common law. The victim of the coercion must show that he was driven to commit the act by threats of personal violence to him which induced a well-grounded apprehension of present death or grievous bodily harm. Even such threats would not excuse his killing an innocent person, for the view of the law was that he ought rather to die himself than escape by the murder of an innocent man. He would be justified, however, in killing his coercer. Modern statutes in some of the United States declare such extreme duress an excuse even for homicide (q.v.).

In civil matters, also, the common-law doctrine of duress is confined within rather narrow limits. Not every form of constraint, unfairly imposed by one party to a contract upon the other, will enable the victim to avoid the contract. Only actual or threatened violence or imprisonment amounts to common-law duress. Moreover, it must be exercised upon the person who makes the contract, or upon the husband, wife, parent, or child of such person; and it must be exercised or instigated or adopted by the one to be benefited by the contract. To amount to duress the

areats employed must be of grievous bodily arm and so made as to terrorize a man of ordinary nerve and courage, or they must be unlawful imprisonment. The doctrine has been somewhat extended in the United States. According to the prevailing view, a person is under duress who is threatened with lawful imprisonment, provided the threat is made to overcome his will and does overcome it and is such as would naturally overcome the will of an ordinary man. A contract made by him in such circumstances does not have his free and true consent. It is imposed upon him by the threatener and is voidable.

A threat to detain or even to destroy property cannot operate as duress according to the narrow view of the ancient common law. In some of our States, however, duress of goods is recognized, and an owner who promises to pay illegal exactions in order to obtain possession of his property is allowed to avoid the promise. Even where the old common-law doctrine prevails, the owner who has paid such exactions may recover the money on the ground that the defendant had received money which belonged to the plaintiff. There must, however, be actual constraint to justify a recovery in such a case. Payment of an illegal claim "under protest" is a voluntary payment and will stand, unless it was forced by actual detainer of property or person, or imminent danger thereof. See QUASI CONTRACT. See also UNLAWFUL INFLUENCE; CONSENT; and consult the authorities referred to under CONTRACT.

**DURET**, du'ră', FRANCISQUE JOSEPH (1804-55). A French sculptor, son and pupil of Francis Joseph Duret (1732-1816). He also studied under Bosio, and won the Prix de Rome in 1823. In 1833 he exhibited his "Neapolitan Fisher mending the Tarantella," now in the Louvre, a spirited statue in bronze, which established his reputation. In the same class is his "Neapolitan Improvisatore" (1839). His works executed for France include: France Protecting Liberty (1855), a group in the grand style for the Louvre; two bronze caryatids for the tomb of Napoleon in the Invalides; a colossal Christ in the church of the Madeleine; the statues of "Comedy" and "Tragedy" for the Théâtre Français; marble statues of Dunois, Philippe of France, Chateaubriand, and Richelieu at Versailles; and the group for the fountain of St. Michel, representing that saint wrestling with Satan. He received the medal of honor in 1855 and was made a member of the Institute in 1845. As professor in the Ecole des Beaux-Arts, he was more influential through his teaching than through his works.

**D'URFÉ**, du'r'fă', HONORÉ. See URFÉ, HONORÉ D'.

**DURFEE**, dər'fē, JOB (1790-1847). An American jurist. He was born at Tiverton, I., graduated at Brown University in 1813, and was admitted to the bar. In 1814-19 and 27-29 he was a member of the State Legislature, from 1821 to 1825 he was in the National House of Representatives as a Federalist, and in 35 he became Chief Justice of the Supreme Court of Rhode Island. He was the author of *hāt Cheer?* (1832), a poem in nine cantos; of *oration, The Influences of Scientific Discovery and Invention on Social and Political Progress*, or *Roger Williams in Exile* (1843), under the pseudonym "Theaptes"; and of a philosoph-

ical work in verse, entitled *The Panidea* (1846). Consult *Complete Works of Job Durfee, with a Memoir of his Life* (Providence, 1849), ed. by his son, and also Gibson, *Discourse on the Character and Writings of Chief Justice Durfee* (Providence, 1848).

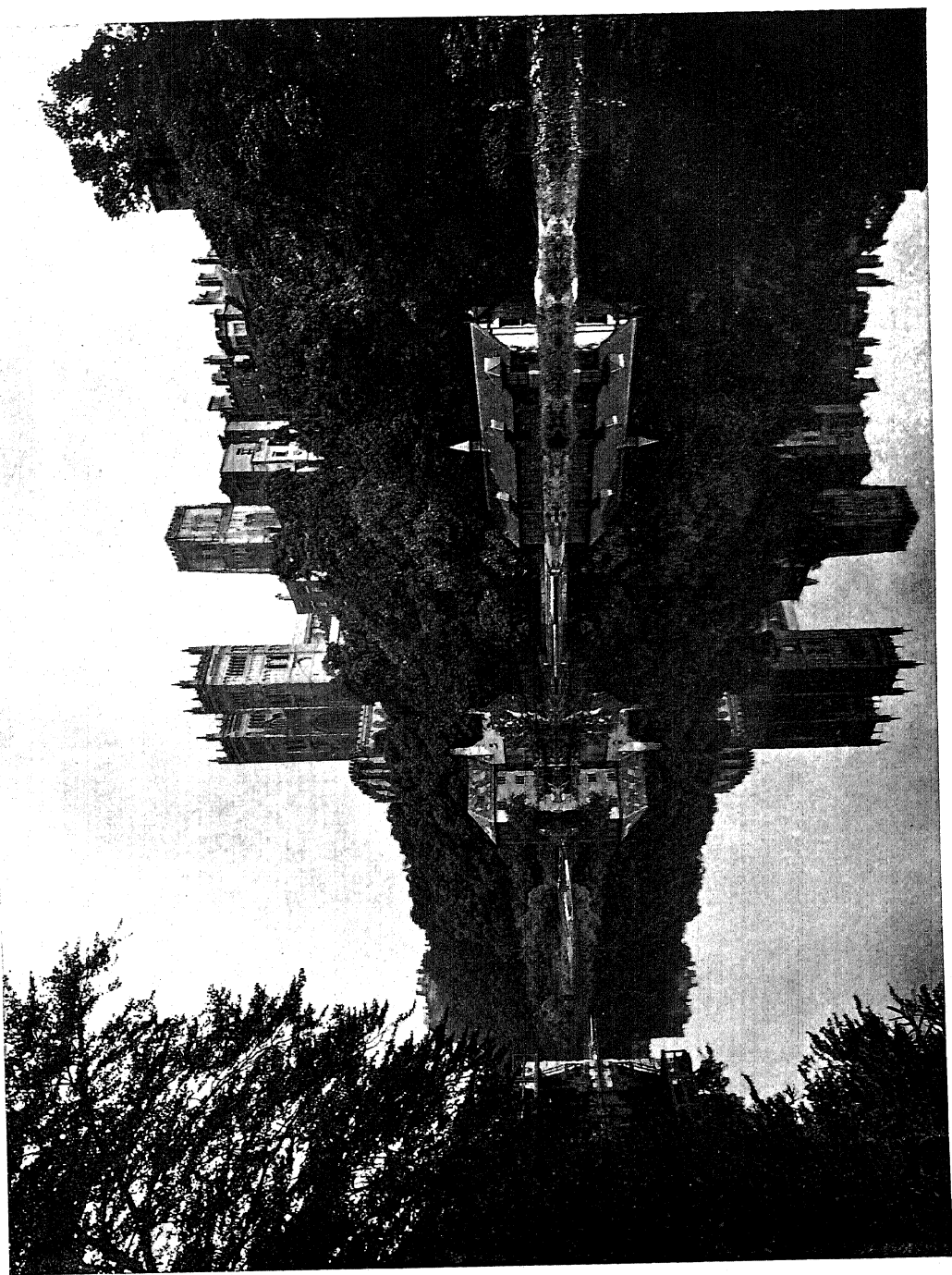
**D'URFÉY**, THOMAS (known as TOM DURFÉY) (1653-1723). An English poet and dramatist, born at Exeter (Devon). He turned from the law to become playwright, and made his first attempt as such with the bombastic tragedy, *The Siege of Memphis* (1676). He was far more successful with his comedies, of which he wrote a considerable number. His popularity was greatly furthered by the songs written by him for his plays and set to music by Purcell and others. Soon he was called upon to compose occasional verse, much of it in glorification of the triumphs of English arms. In Charles II, James II, William and Mary, and Anne, he was shown marked tokens of favor. Latterly, it appears, he became reduced to poverty, and his friends, Addison and Steele, obtained for him a benefit performance of his *Plotting Sisters* at Drury Lane. He was a mirthful fellow, who, as Addison says, "made the world merry," turned out song after song with slight effort, and himself sang them with good spirit and applause. Several collections and recensions of his songs and poems, some with music, appeared between 1661 and 1720, the first entitled *An Antidote against Melancholy Made up in Pills*. He wrote further *Tales, Moral and Comical* (1706). His dramatic works were published contemporaneously, but have never been collected.

**DURGĀ**, dūr-gū' (Skt., impassable). In Hindu mythology, one of the names by which the consort of the god Siva is known. This is her title when she appears in her fear-inspiring form. Similar is her awful manifestation as Kālī, "Black," a dreadful goddess. Her image is often seen in Hindu temples. In her more pleasing aspect she is the same as Umā, Pārvatī (q.v.). Her festival is the most popular of Bengal and is the occasion of universal rejoicing. Consult: Dowson, *Hindu Mythology* (London, 1879); Wilkins, *Hindu Mythology* (2d ed., ib., 1902); an article by B. Mazumdar in the *Journal of the Royal Asiatic Society* (1906).

**DURHAM**, dūr'am. A maritime county of the northeast of England, between the Tyne and Tees (Map: England, E 2). It has 32 miles of coast, generally low, but with some cliffs, and an area of 1014.6 square miles, five-sevenths being arable. Durham is one of the chief counties in England for the production and export of coal and also for the mining of lead. Shipbuilding is an important industry, the establishments on the Tyne ranking next to those on the Clyde. Founding and metal working rank next, and there are also extensive manufactures of chemicals, paper, earthenware, glass, and bottles. More limestone is produced than by any other county in the United Kingdom. The agricultural products are oats, barley, wheat, turnips, beans, and peas. The Teeswater breed of short-horned cattle is well known, and excellent draft and saddle horses are raised. Pop., of the ancient or geographical county, 1901, 1,187,474; 1911, 1,369,860; of the administrative county, on which census returns are based, 1901, 768,024; 1911, 929,340. The capital is Durham (q.v.).

Previous to the Roman invasion Durham was





DURHAM CATHEDRAL AND THE RIVER WEAR  
FROM A PHOTOGRAPH



in the possession of the Brigantes and under Roman rule became part of the Province Maxima Caesariensis. When the Anglo-Saxons gained control, it became part of Bernicia, and hence of the Kingdom of Northumbria, until the Norman Conquest. Under the Normans it obtained the privileges of a county palatine, and for many years its affairs were administered by the bishops, who enjoyed larger temporal prerogatives than in most of the other counties. In 1536 Henry VIII stripped them of many of their juridical powers, but it was not until 1836, after the death of Bishop van Mildert, that an Act of Parliament removed all temporal jurisdiction and privileges forever from the bishopric. Consult: Palmer, *The Tyne and its Tributaries* (London, 1882); Lapsley, *The County Palatine of Durham* (New York, 1900); and the Surtees Society publications.

**DURHAM** (AS. *Dūnholm*, hill isle, from *dūn*, hill, down + *holm*, island). A parliamentary and municipal borough and ancient episcopal city of England, the capital of the County of Durham, 60 miles north-northwest of York. It is built around a steep rocky hill, 86 feet high, nearly encircled by the Wear, which is here crossed by three bridges (Map: England, E 2). On the top of the hill are the cathedral and castle. Ancient walls partly inclose the hill, from which fine views are obtained of the fertile wooded country and of the suburbs across the river. On the site of a church built by Bishop Ealdhune, in 995, Bishop William de Carlepho, about 1093, began the present magnificent cathedral, one of the finest Norman churches in England, to which additions continued to be made till about 1500. It thus exhibits the gradual changes of style between these periods. It is 510 feet long, 80 feet wide, 170 feet across the transepts, and 70 feet high. The central tower is 214 feet high, and the west towers each 138 feet. It contains the tombs of St. Cuthbert (q.v.) and the Venerable Bede. Among the chief buildings connected with the former monastery are the dormitory, now used as the new library, a refectory hall in practically its original condition, and the refectory, now the old library. The castle—formerly the residence of the bishops of Durham, but now the seat of the University of Durham—was founded about 1072 by William the Conqueror. It was built in the Romanesque style, but it has since been much altered. The present University of Durham was opened for students in 1833. A royal charter in 1837 empowered the university to bestow degrees. It has two colleges—University College and Bishop Hatfield's Hall. The corporation maintains markets and public baths. Durham has long been famous for its mustard. The town sends one member to Parliament. Pop., 1901, 16,151; 1911, 17,550. Durham arose about the year 995, when Bishop Ealdhune brought here St. Cuthbert's bones from Ripon and built a church to enshrine them. It became the seat of the Bishop and Count Palatine of Durham County. Consult: *Bygone Durham*, ed. by Andrews (London, 1898); Low, *Durham* (ib., 1897); Bygate, *The Cathedral Church of Durham* (New York, 1899); Leighton, *Memorials of Old Durham* (London, 1910); Grierson, *Tales of English Minsters* (ib., 1910); Kitchin, *Story of the Deanery* (Durham, 1912).

**DURHAM**. A city and the county seat of Durham Co., N. C., 26 miles northwest of Raleigh, on the Southern, the Norfolk and West-

ern, the Seaboard Air Line, and the Durham and Southern, and the Durham and South Carolina railroads (Map: North Carolina, D 1). It is an important manufacturing centre for tobacco, cigars, and cigarettes, having one of the largest granulated smoking tobacco factories in the world. There are also cotton mills, sash and blind factories, foundries, a fertilizer factory, and other industries. Trinity College (Methodist Episcopal, South), opened in 1851, is located here. The city has also a school of fine art and a conservatory of music, a public library, and Watts Hospital. The government is administered under a charter of 1899 which provides for a mayor, chosen every two years, and a city council, elected on a general ticket. Settled about 1855, Durham was incorporated in 1869 with a population of 200. Near here General Johnston, with the Confederate army, surrendered to General Sherman on April 26, 1865. Pop., 1900, 6679; 1910, 18,241; 1914 (U. S. est.), 22,863.

**DURHAM**, JOHN GEORGE LAMBTON, first EARL OF (1792-1840). An English statesman, born in London. After an education at Eton he held a commission in the army for a short period. At 21 years of age he made a runaway marriage at Gretna Green with Harriet Cholmondeley, who died three years after. He married Lady Louisa Elizabeth Grey, daughter of Earl Grey, 18 months later, and by this union he regained his political position. In 1813 he entered Parliament for Durham as an advanced Liberal. In 1828 he was created Baron Durham of the city of Durham. He was one of the four persons who prepared the Reform Bill and supported it in the House of Lords. In 1833 he was appointed Ambassador Extraordinary to Russia. After a second mission to Russia he was appointed in 1838 Governor-General of Canada, where a formidable rebellion had broken out. In his efforts to suppress the insurrection he exceeded the powers conferred upon him, and Lord Brougham, with whom he had differences, took advantage of the situation to interpellate his conduct in the House of Lords. Incensed at a vote of disapproval, Durham returned to England without being recalled or obtaining the royal consent. The important report on Canadian affairs prepared under his direction by his secretary, Charles Buller, advocated liberal changes in colonial policy which were adopted by his successors. He died at Cowes, Isle of Wight, in 1840.

**DURHAM BOOK**, THE. An edition of the Gospels, with Northumbrian-Saxon glosses, the work of St. Cuthbert, the sixth Bishop of Durham.

**DURHAM CATTLE**. See CATTLE.

**DURHAM LETTER**, THE. A letter of Lord John Russell to the Bishop of Durham in 1850, protesting against the invasion of Catholicism in the United Kingdom and especially in the Established church itself. It resulted in the passage of a bill, which, however, was not enforced, against the establishment of a Roman Catholic hierarchy in England.

**DURIAN** (Malay *duryon*), or **D'URION** (*Durio zibethinus*). A fruit tree of the Malayan Archipelago, of the family Bombacaceæ. It is a lofty tree, with leaves resembling those of the cherry and with large bunches of pale-yellow flowers. The fruit is of the size of a large coconut; roundish oblong, with a hard thick rind, covered with soft spines, so that

it somewhat resembles a hedgehog rolled up. The pulp of the fruit is of creamy consistency and delicious taste, but has a smell which is very repulsive until a taste for the fruit is acquired. Persons accustomed to it, however, universally regard the durian as one of the very finest fruits of the East. In the Indian markets it commands a higher price than any other native fruit. It contains 10 or 12 seeds as large as pigeons' eggs, which, when roasted, are not inferior to chestnuts. One tree yields about 200 fruits in a year. For illustration, see Plate of DAHLIAS, ETC.

**DURIE**, or **DURY**, JOHN (1596-1680). A Scottish Protestant advocate of church unity. He was born in Edinburgh; his education was received at Sedan and Leyden, and most of his life was passed on the Continent. At home he held the position of chaplain to Charles I and Mary, Princess of Orange, and was a member of the Westminster Assembly. His reputation rests upon his ' ' ' ' ' though fruitless efforts to unite ' ' ' ' and Reformed, the Presbyterian and Congregational churches, an object for which he pleaded in every place to which his extensive travels brought him and with every prominent person he met. He died at Cassel, Germany, Sept. 26, 1680.

**DÜRING**, dü'ring, AUGUSTE. \*See CRELINGER, AUGUSTE DÜRING.

**DÜRINGSFELD**, dü'rings-fält, IDA VON (1815-76). A German author, born at Militsch, Lower Silesia, whose novels and books of travel were much read in her day. She was the daughter of an army officer and was a diligent student of languages, devoting herself particularly to Italian and Bohemian folklore. She published a volume of poems entitled *Gedichte von Thekla* (1835; 2d vol., entitled *Für Dich*, 1850; 2d ed., 1865). Her other productions include: *Schloss Goczyn*, a novel (2d ed., 1845); *Magdalene*, a novel (1844); *Skizzen aus der vornehmen Welt* (1842-45); *Margareta von Valois*, a historical novel (1847); *Böhmische Rosen*, a collection of Bohemian folk songs (1851); *Lieder aus Toscana*, Tuscan folk songs (2d ed., 1859); *Das Buch denkwürdiger Frauen* (5th ed., 1896). Several works, including the celebrated collection of proverbs *Sprichwörter der germanischen und romanischen Sprachen* (2 vols., 1872-75), were also written by her in collaboration with her husband Otto von Reinsberg, who committed suicide on the day after her death.

**DURIS** (Lat., from Gk. Δούρις, *Douris*) OF **SAMOS** (c.350-c.280 B.C.). A Greek historian, a descendant of Alcibiades, and brother of Lynceus. At one time he was tyrant of Samos. He wrote a number of historical works, of which the most important was 'Η τῶν Ἑλληνικῶν Ἱστορία, or *The History of Greece*, from the battle of Leuctra (371 B.C.) to the death of Lysimachus (281 B.C.). Both the judgments passed on him in antiquity and his remaining fragments support the belief that he was merely a careless and uncritical collector of historical materials. He wrote also on the theatre, on tragedy, and on the history of art. Consult: Müller, *Fragmenta Historicorum Græcorum* (Heidelberg, 1806); Hulleman, *Duridis Samii quæ Supersunt* (Utrecht, 1841); Bury, *The Ancient Greek Historians* (New York, 1909).

**DÜRKHEIM**, dürk'him. A town of the Bavarian Palatinate, Germany, on the Isenach, at the foot of the Haardt Mountains, about 13

miles west-southwest of Mannheim (Map: Germany, C 4). It is surrounded by vineyards and frequented as a health resort for the saline springs of Philippschalle, which belong to the town. Its chief industries are the manufacture of paper, oil, leather, and paints, and the preparation of salt, and a considerable trade in grain and sparkling wine is carried on. At the entrance to the Isenach valley are the picturesque ruins of the abbey of Limburg, founded in 1230 by Conrad II. It was destroyed by the French in 1689. Pop., 1900, 6207; 1910, 6523. Consult Schäfer, *Wegweiser für Dürkheim* (Dürkheim, 1896).

**DURKHEIM**, dü'r'kän', EMILE (1858- ). A French philosopher, born at Les Vosges. He was educated at the Ecole Normale Supérieure, traveled in Germany, and made valuable studies of social conditions there. The first French chair in sociology at the University of Bordeaux was founded for him (1887), and he became a full professor six years later. His special aim was to separate sociology from mere psychology and to examine social conditions in the light of other observed social facts. In the field of psychology his writings treat of the distinctions between individual mental phenomena and "Folk psychology." They include: "L'Individualisme et les intellectuels," in *Revue Bleue* (1898), and "Représentations individuelles et représentations collectives," in *Revue Métaphysique* (1898). Mention should also be made of his general study: "La science positive morale en Allemagne," in *Revue Philosophique* (1887); and of his books: *De la division du travail social* (1893); *Les règles de la méthode sociologique* (1894); *Le suicide* (1897); *Les formes élémentaires de la vie religieuse, le système totémique en Australie* (1912). He founded in 1898 and thereafter published annually *L'Année Sociologique*.

**DURLACH**, döör'läch. An old town in the Grand Duchy of Baden, Germany, on the Pfalz, 3 miles east of Karlsruhe (Map: Germany, C 4). Durlach manufactures tobacco, chicory, leather, gloves, brushes, chemicals, organs, sewer pipe, and machinery, and has extensive fruit and grain markets. The environs abound in orchards. On the summit of the Thurmburg overlooking the town is a lofty tower believed to be of Roman origin. Remains of ancient walls and fortifications are still to be seen. Pop., 1900, 11,400; 1905, 12,707; 1910, 13,896. Consult Fecht, *Geschichte der Stadt Durlach* (Heidelberg, 1869).

**DÜRNSTEIN**, dürn'stin. A village of Lower Austria, situated in a highly picturesque spot on the left bank of the Danube, about 45 miles west-northwest of Vienna (Map: Austria, D 2). It is noteworthy for the ruins of a castle where Richard Cœur de Lion is said to have been imprisoned three months in 1193. Near by, the French were defeated by the Austrians and Russians, Nov. 11, 1805. Pop., about 700.

**DUROC**, dü'rök', GÉRAUD CHRISTOPHE MICHEL, DUKE OF FRULI (1772-1813). A French soldier and diplomatist, born at Pont-a-Mousson. He was educated at the Military Academy of Chalons, joined Napoleon as sublieutenant of artillery at the siege of Toulon, and became one of his favorite officers. In the Italian and Egyptian campaigns he was Napoleon's aid-de-camp and at Marengo served as a brigadier general. During the Empire he was general of

division, grand officer of the Legion of Honor, and grand marshal of the palace. Because of his shrewdness and the confidence that Napoleon placed in him, he was sent on diplomatic missions to various European courts. He fought at Austerlitz, Aspern, and Wagram, and was killed in a skirmish near Markersdorf after the battle of Bautzen (1813). He was honored by burial in the Invalides at Paris.

**DUROVERNUM.** See CANTERBURY.

**DURRA.** See SORGHUM, *Nonsaccharine*; ANDROPOGON.

**DURUM WHEAT.** See WHEAT.

**DURUY**, du'rwe', VICTOR (1811-94). A French historian and educator. He was born in Paris, Sept. 11, 1811, of obscure parents, his father being a workman in the lace works at Gobelins. Duruy did not begin his education until late in life, but was admitted in 1830 to the Ecole Normale Supérieure. He graduated in 1833 and became professor of history in the college at Rheims, but soon received a call to Paris, where for 25 years he held an honorable position in the Lycée Henri IV. An admirable teacher, he employed his spare time in the writing of textbooks on history and geography and soon became prominently known in the field of education. In 1853 he received the degree of Litt.D., but he did not leave the lycée until 1861, when he was made inspector of the Academy of Paris. He became successively *maître de conférences* at the Ecole Normale, Inspector General of Public Instruction, and, finally, professor of history in the Ecole Polytechnique. In 1863 Duruy was made Minister of Public Instruction by Napoleon III, whom he knew personally, having assisted that versatile ruler in collecting material for his *Vie de César*. For six years Duruy presided over the Department of Public Instruction, and to him is due in great part the modern system of education in France, especially the organization of secondary instruction. He was liberal in his views and devised many improvements in the educational system of France, which, however, his opponents, the Clericals and Conservatives, vehemently opposed. On the reorganization of the ministry in 1869 Duruy resigned his portfolio and was given a seat in the Senate. After the events of 1870 he retired into private life. The last years of Duruy's life were spent in historical research, the results of which were his great *Histoire des Romains* (7 vols., Paris, 1879-85), and his *Histoire des Grecs* (3 vols., ib., 1886-91). An English translation of the former of these appeared in London (1883-86). Most of his other works were school histories in Hachette's series *L'Histoire universelle*, the best-known volumes being the histories of Greece and Rome (Eng. trans., ed. by Mahaffy, London, 1888), and his *Student's History of France* (Eng. trans., New York, 1889). He died in Paris, Nov. 25, 1894. His son, Albert Duruy (1844-87), acquired some reputation as an historical writer on the period of the Revolution and as a Bonapartist partisan, while another son, Georges, born in 1853, has written a number of romances, historical and political. Consult Lavissee, *Un ministre, Victor Duruy* (Paris, 1895), and Bigelow, "Lavissee's Life of Duruy," in *American Historical Review*, vol. i (New York, 1896).

**DURWARD**, der'wërd, QUENTIN. The hero of Scott's novel of the same name.

**DURYEA**, dūr-yā' or dōr-yā'. A borough in

Luzerne Co., Pa., 9 miles south of Scranton, on the Lackawanna River, and on the Erie, the Lehigh Valley, and the Delaware, Lackawanna, and Western railroads. The chief industries are coal mining and the manufacture of silk. Duryea was incorporated as a borough in 1901. Pop., 1910, 7487.

**DURYÉE**, dūr-yā', ABRAM (1815-90). An American soldier. He was born in New York City, was educated in the common schools, and afterward acquired considerable wealth as a dealer in mahogany furniture. He entered the State militia in 1833, became colonel of the Twenty-seventh Regiment (now the Seventh) in 1849, holding that office for 14 years. He took a conspicuous part in suppressing the numerous riots which occurred in that period. At the beginning of the Civil War he raised a regiment which became widely known as Duryée's Zouaves. He was promoted to be brigadier general of volunteers in August, 1861, but resigned from the service in January, 1863, owing to a disagreement over a question of rank. In 1865 he was brevetted major general for service at the battles of Cedar Mountain, Rappahannock Station, Thoroughfare Gap, Groveton, Chantilly, South Mountain, and Antietam. He was appointed police commissioner of New York City in 1873, and in the following year attacked and dispersed a company of communists assembled in Tompkins Square.

**DUSART**, du-särt', CORNELIS (1660-1704). A Dutch genre painter and etcher, born at Haarlem. He was a pupil of Adriaen van Ostade (q.v.). His works are very uneven in quality, some of them equaling the work of his master, in whose style he paints; but most of them are inferior in color and draftsmanship. He usually represents kermesses, tavern scenes, and other popular amusements, and his peasant types frequently degenerate into satirical caricatures. The best of his works are in the galleries of Amsterdam, Dresden, Vienna, and Berlin. His etchings and engravings are very numerous, and his drawings much sought after. Dusart was also an art collector of some importance.

**DUSE**, dōō'zā, ELEONORA (1859- ). An Italian actress, born at Vigevano, on the border of Piedmont and Lombardy. Hers was a family of actors, her grandfather having founded the Garibaldi Theatre in Padua, and she appeared on the stage when 13 years old. Her early stage life in itinerant companies was a succession of privations and hardships, which seriously impaired her health, but she was soon recognized at Naples, and a little later at Milan (1885), as the greatest actress of Italy and one of the greatest of her time. Her subsequent career was one of extraordinary success.

She won an international reputation at Vienna in 1892 and elicited successively enthusiastic responses in the principal cities of Europe. Her American début she made in January, 1893, as Camille, at the Fifth Avenue Theatre in New York City, and she appeared in London for the first time the same year. In 1897 she went to Paris, where she was regarded as the great rival of Sarah Bernhardt. Among her most noted presentations were those of Juliet, Francesca da Rimini, Marguerite, Camille, Fernande, Magda, and Paula in *The Second Mrs. Tanqueray*. To show her unusual versatility, she sometimes plays on the same evening such contrasted rôles as Santuzza in *Cavalleria Rus-*

*ticana* and the rollicking heroine of *La Locandiera*. For several years she was closely associated with Gabriele D'Annunzio, and some of his best-known plays were written for her. Much of his success on the stage was undoubtedly due to her interpretation of his work. They quarreled in 1899, and while she continued to act in his plays, their former friendship never was renewed. Her art is distinguished for its simplicity, yet subtle intensity of expression. Discarding all make-up and many of the customary mannerisms of the stage, she gained her extraordinary dramatic power by the abandonment of much that is conventional but unreal in modern acting. In private life she is noted for her dislike of personal publicity. Her marriage did not prove happy, and she separated from Signor Checchi. In 1902 she reappeared in America. After this she acted at intervals in Italy and made brief tours in Germany, but her health was such that she was compelled for the most part to live in retirement. Consult: Bracco, *Life of a Famous Actress*, with American press notices (New York, 1893); Mapes, *Duse and the French* (ib., 1898); Huneker, *Iconoclasts* (ib., 1905); Symonds, *Studies in Seven Arts* (London, 1906).

**DUSHAN, STEPHEN.** See STEPHEN DUSHAN. **DUSOMMERARD**, du'sóm'rär', ALEXANDRE (1779-1842). A French architect, born at Bar-sur-Aube. After serving in the army he was appointed a member of the Cour des Comptes in 1807, where he evinced decided Bourbon proclivities, and in 1831 he was made Master Councilor. He also devoted himself to archaeological studies, traveled through France and Italy, and eventually became the founder of the famous Musée Cluny in Paris. This collection of mediæval implements and objects of art was begun by Dusommerard during the First Empire and was originally to decorate the Hôtel Cluny, the so-called Hôtel Clur; it became the greatest collection of its kind in France, and together with the mansion of Dusommerard was after his death bought by the government and converted into a museum, to which building the adjacent Palais des Thermes was afterward added. Dusommerard began the work subsequently published under the title *Les arts au moyen âge* (1838-46) and containing more than 500 plates, and was the author of *Notices sur l'Hôtel de Cluny et le Palais des Thermes* (1834).

**DUSSEK**, dö'sshék, JOHANN LADISLAUS (1761-1812). A Bohemian musician and composer. He was born at Czaslau, Bohemia, and received his earliest musical impulse as a boy singer at the Minorite Church, Iglau. His first teacher was Father Spenar, and his lessons were given during his attendance at the Jesuit College. After this he had a varied career, his reverses being chiefly due to love of luxury, lack of method, and of business. He has been rightly called the pioneer of national music, and in his pianoforte playing he is credited with rivaling Clementi in the introduction and use of the "singing tone." His compositions, which include 12 concertos, 53 piano sonatas, 80 violin sonatas and much chamber music, were very popular in their day, but are forgotten to-day. A pianoforte method published in London had a very extended vogue. He died at Saint-Germain-en-Laye.

**DÜSSELDORF**, dus'sel-dôrf. The capital of

the government district of Düsseldorf, in the Prussian Rhine Province, situated in the centre of a fertile district, on the right bank of the Rhine, at the confluence of the Düsseldorf with that river, 24 miles by rail north by west from Cologne, in lat. 51° 13' N., long. 6° 46' E. (Map: Prussia, B 3). Düsseldorf is divided into five main parts: the Altstadt, the original town, on the right bank of the Düsseldorf; the Karlstadt, founded in 1786 by the Elector Karl Theodor, on the left bank; the Neustadt, on the Rhine, laid out between 1690 and 1716; the Friedrichstadt, to the south; and the Königstadt. It also takes in the suburbs of Unterbilk, Oberbilk, Flingern, and Derendorf. The Altstadt has narrow, irregular streets, but for the most part Düsseldorf is well built and abounds in broad, well-shaded avenues and fine squares. A colossal bronze equestrian statue of the Elector Johann Wilhelm, who founded the famous picture gallery here in 1710—the greater part of which, however, was removed to Munich in 1805—stands in the Altmarkt.

Among the principal buildings of Düsseldorf are the town hall, dating from 1567, with a new wing added in 1885; the Academy of Art; the Kunsthalle with a municipal gallery of modern Düsseldorf artists; the handsome municipal theatre; the Provincial Ständehaus (House of the Rhenish Estates), in the Italian Renaissance style; the palace of justice; the Reichsbank; and the palatial new post office. Of the 37 churches (of which 26 are Roman Catholic), the most noteworthy are St. Lambert's (a Gothic edifice of the fourteenth century), St. Andrew's, Maximilian's, the new Gothic church of St. Mary, and St. Martin's. The Hofgarten is one of the finest public gardens in Germany; in it is situated the War Memorial, erected in 1892 to commemorate the campaigns of 1864, 1866, and 1870-71. Düsseldorf owns and operates a gas plant, its water works, street railways, and, since 1891, an electric plant. The educational institutions include a number of gymnasia and realschulen, a teachers' seminary, and an industrial art school. The town has been for two centuries an art centre and is the home of the famous Düsseldorf school of painters. The historic Academy of Art was founded in 1767. Among its pictures are an Assumption by Rubens, a Madonna by Bellini, and the remarkable fresco series by Janssen. The historical museum has a valuable collection of documents. There are also an industrial museum and a library with 50,000 volumes. Düsseldorf is one of the chief centres of the iron industry in Germany. It has, besides, a number of textile mills, breweries, distilleries, etc. The commerce is extensive. Düsseldorf is the seat of many consuls, including one from the United States. Like most German cities, it has increased in population remarkably during the last three decades, owing in part to the annexation of suburbs. In 1880 it had 95,190 inhabitants; in 1900, 213,711; in 1910, 358,728.

Düsseldorf was known as early as the twelfth century. It received municipal rights from Count Adolf of Berg in 1288 and in 1385 became the residence of the counts of Berg. In 1609 it became the residence of the counts palatine of Neuburg, and subsequently became part of the Electoral Palatinate, which in 1779 was united with Bavaria. It prospered greatly under the counts and electors palatine, some of the chief buildings and institutions of the city dating

from that period. From 1795 to 1801 Düsseldorf was held by the French; in 1806 it became the capital of the Grand Duchy of Berg and was annexed together with the Grand Duchy to Prussia in 1815. Consult: Ferber, *Historische Wanderung durch die alte Stadt Düsseldorf* (Düsseldorf, 1890); Clemen, *Die Kunstmaler der Rheinprovinz*, vol. iii, part i, *Stadt und Kreis Düsseldorf* (ib., 1894); Brandt, *Studien zur Wirtschafts- und Verwaltungsgeschichte der Stadt Düsseldorf* (ib., 1902).

#### DÜSSELDORF SCHOOL OF PAINTING.

One of the most important, if not the most important, German schools of the nineteenth century. It was the outgrowth of the Academy of Art, founded at Düsseldorf by the Elector Palatine Karl Theodor in 1767, but did not attain importance until Düsseldorf became part of Prussia. The academy was reorganized by Frederick William III, who made Cornelius director. The latter did not hold his post long enough to impress his views upon the school, which represents rather the tendencies of Schadow, under whom it came into great prominence. While the school of Munich, under Cornelius, was a school of drawing, interested chiefly in frescoes, that of Düsseldorf was a real school of painting, which worked chiefly on panels and canvas, and paid some attention to color. It was technically superior to all the other German schools. More than any other school it represented the Romantic tendencies in Germany. In secluded Düsseldorf the artists lived apart from the world, entirely in the past, and transformed into painting the verses of Goethe, Shakespeare, and the rest. Their works, on the whole, bear unfavorable comparison with those of the French Romantic school, both from the standpoint of feeling and from that of technique. The school suffered much from dissensions between Catholics and Protestants, the former advocating strictly religious subjects, while the latter took a more liberal view. Among the most famous representatives of the school were Lessing, Hildebrandt, Sohn, Rethel, the Achenbachs, Knaus, and Deger (qq.v.). It has had a great influence upon art in America, such men as Eastman Johnson, Leutze, and Bierstadt having done much to introduce its methods and style. The fine collection of old masters formerly possessed by the Düsseldorf Academy was transferred to Munich in 1805, but some 14,000 drawings and 24,000 engravings of the great masters still remain. Consult the works entitled *Die Düsseldorfer Malerschule*, by Fahne (Düsseldorf, 1837), Püttmann (Leipzig, 1839), and Rosenberg (ib., 1886); the monographs on *Die Düsseldorfer Kunstakademie*, by Wiegmann (Düsseldorf, 1854) and Woermann (ib., 1880); those entitled *Düsseldorfer Künstler* by Müller (Leipzig, 1854) and Blanckarts (Stuttgart, 1877); Schaarschmidt, *Zur Geschichte der Düsseldorfer Kunst* (Düsseldorf, 1902).

**DUSSEUX**, du'syē', LOUIS ETIENNE (1815-94). A French geographer and historian, born at Lyons. He became professor of history at Saint-Cyr in 1850. Besides his excellent contributions as a collaborator to the *Encyclopédie Nouvelle* and the *Annales Archéologiques*, he edited the *Mémoires* of the Marquis de Dangeau and of the Duc de Luynes, and the *Lettres intimes* of Henry IV, a work of considerable historical value. His original publications include: *L'Art considéré comme le symbole de l'état social*

(1838); *Essai historique sur l'invasion des Hongrois en Europe et spécialement en France* (1838); *Recherches sur l'histoire de la peinture sur émail* (1839-40); *Géographie historique de la France* (1844); *Le Canada sous la domination française* (1855); *Cours classique de Géographie* (1859-65); *Le Cardinal de Richelieu* (1885); *Etude biographique sur Colbert* (1886); etc.

**DUST** (AS. *dust*, Ger. *Dust*, connected with Ger. *Dunst*, vapor, OHG. *dunist*, *tunist*, breath, storm, Goth. *dauns*, odor, Skt. *dhvans*, *dhvas*, to fall to dust, to perish), **ATMOSPHERIC**. It is a familiar fact that dust is always present in the atmosphere, not merely in houses and near the ground out of doors, but over the ocean and even on the tops of mountains. In order to obtain air absolutely free from dust, it may be filtered slowly through plugs of cotton wool, or it may be suddenly expanded so as to cool below the dew point, when a portion of its moisture will condense upon the particles of dust and cause them to settle quickly to the bottom of the collecting vessel. When a beam of sunlight shines through dustless air, nothing is seen by an observer standing at one side, but if dust is present the sunlight is scattered in all directions and the beam of light is said to become visible. When atmospheric dust is collected and examined under a microscope, it is seen to consist largely of grains of pollen, bits of vegetable fibre, and hairs and all kinds of mineral fragments, including occasionally metallic iron. When, on the other hand, dust is allowed to settle upon properly prepared slides, or the jellies and broths used for "cultures" in bacteriology, and is kept in a warm room, there usually springs up in a few days a vigorous growth of fungi and bacteria, showing that living germs were present, although they may have been invisible in the ordinary microscope. Such dust gives rise in nature to growths that were formerly spoken of as spontaneous generation; but it is now abundantly demonstrated that they simply prove the previous existence of living germs. Some of these germs are highly injurious to men and animals and are the sources of epidemic diseases; others, when brought to the ground by means of rain, may germinate on the wet soil and produce characteristic fungi. These are sometimes black, giving rise to what is called black rain (q.v.); sometimes red, giving rise to red rain or blood rain and occasionally green snow or red snow. When yellow pollen is brought down and spread on the wet ground, it is often spoken of as a rain of sulphur. No fermentation, souring, festering, or other trouble caused by the development of bacteria and fungi can originate in absolutely pure air.

Showers of dust occur in connection with active volcanoes, prairie fires, forest fires, tornadoes, and strong winds, that elevate the dust in one region only to deposit it in another. Ordinary storm winds sweeping over a forest and robbing the trees of their pollen produce showers of sulphur or other forms of dust within a few hundred miles. Remarkable dust showers originate in the region of the Sahara in north Africa. This dust, which is exceedingly fine and usually red, has been transported 1200 miles to the north across the Mediterranean into Europe. (See the description of the dust storm of Feb. 25, 1879, on page 34 of *Bartholomew's*



*Atlas of Meteorology*, and that of the red dust of 1901 in *Nature*.) Almost as far to the west and southwest of the Sahara a fine white dust falls on vessels in the Atlantic Ocean during the so-called harmattan (q.v.), or very dry winds blowing out from the interior of the desert region. Examination of this dust shows it to be almost exclusively composed of the tests of diatoms—microscopic organisms, growing on the vegetation in the fresh water of the interior. The formation known in geology as loess (q.v.) is an exceedingly fine, friable soil, easily raised by the wind and carried to great distances. This formation exists in China in layers of several hundred feet in depth, and in the prairie region of North America to a depth of 100 feet or less, and is supposed by many to owe its origin entirely to the dust carried by the wind in certain seasons of the year. A shower of black snow due to this dust is described in the *United States Monthly Weather Review* for January, 1895, pp. 15-19. Among the most remarkable showers of dust and ashes are those that have attended volcanic eruptions, such as those of Vesuvius. The cloud of dust proceeding from Skaptar Jökull in Iceland during the eruption of May 20 to June 18, 1873, extended southeastward 2000 miles, over all of Europe and still farther into Syria. The dust from an eruption of Cotopaxi was calculated by Mr. Whympster to represent 2,000,000 tons of material; that from the volcano Soufrière in the island of St. Vincent, West Indies, on April 30, 1812, fell on Barbados, 50 miles to the east, to the depth of 1 inch, and extended thence eastward beyond the horizon during May 1. The great eruption of ashes and vapor from Krakatoa in the Straits of Sunda, during Aug. 26 and 27, 1883, spread a cloud of dust and vapor over the whole globe between lat. 10° S. and 60° N., some of which, remaining at a great height, was observable three years later. The dust collected 900 miles west of the volcano was similar in composition to that collected only 100 miles distant. A great fall of dust attended the eruptions on Martinique and St. Vincent in 1902 and produced striking sunset glows, similar to those that were developed by the ejected ashes from Krakatoa. Dust falls and atmospheric phenomena but slightly less marked than those of 1902 resulted from the great explosion of Katmai volcano, Alaska, June 6-10, 1912. (Consult H. H. Kimball in *Monthly Weather Review*, 1913, vol. xli, pp. 153-159.)

The great importance of dust in the formation of cloud and rain has been especially elucidated by the labors of Mr. John Aitken, of Falkirk, Scotland, who has shown that in the ordinary process of the formation of cloud or fog by cooling air the condensation of the moisture takes place first upon the particles of dust as nuclei; that, in fact, every particle of dust collects moisture, and that every particle of cloud or fog implies a nucleus of dust. On this fundamental principle Aitken has based the construction of his so-called dust counter, which he has made quite portable, and which enables one to determine with close proximity the relative and the absolute dustiness of any sample of air. He has made such determinations in many parts of Europe and in a great variety of places. The dustiest air is found in the cities; thus, in London, Edinburgh, and Paris there are from 80,000 to 210,000 particles per cubic centimeter

(about the fifteenth part of a cubic inch). The air having least dust, so far as yet observed, is that of the western Scotland—viz., from 7600 down to 1000 per cubic centimeter; the air of the Swiss mountain tops has a similar small content of dust. Aitken's investigations have explained quantitatively that which was before known only qualitatively—viz., that the air most soothing to those who are troubled with delicate lungs is that which has the least dust. According to these results the presence of dust makes it easier for cooling air to form cloud or fog. Cloudy or foggy air must be considered as dustless air in which the dust previously existing is now replaced by minute floating globules of water. If, now, this dustless but foggy air is still further cooled, its surplus aqueous vapor, which does not easily condense upon the globules already present, supersaturates the dustless air, thus bringing about a condition of unstable equilibrium. This condition has been especially investigated by C. T. R. Wilson of the Cavendish Laboratory, Cambridge, England, who has shown that condensation eventually takes place, but only after a considerable additional cooling and with violence. In this process latent heat is set free and phenomena produced which imitate those observed in the interior of thunderclouds from which rain is falling. It would seem plausible to conclude, therefore, that, whereas dusty air is necessary for the formation of clouds, dustless air is necessary for the formation of rain.

When dust is very fine and uniform in size, it gives rise to beautiful optical phenomena due to the diffraction and interference of light, such as the wonderful red, green, and yellow sunsets and sunrises, and the blue suns visible during the daytime in the years 1883-85. These occurred in connection with the vapor dust from the Krakatoa eruption, but similar phenomena have been observed on numerous other occasions after volcanic eruptions.

Among the important works on this subject may be mentioned C. G. Ehrenberg, on *Infusoria* (Leipzig, 1838) and *Micro-geology* (Berlin, 1856); J. W. Bailey, numerous papers in the *American Journal of Science*, from 1838 to 1856; John Aitken, numerous papers in the *Transactions of the Royal Society of Edinburgh*, and his paper, *Observations of Atmospheric Dust*, read before the Chicago Meteorological Congress of 1893 (see *United States Weather Bureau Bulletin No. 11*, pp. 734-754); Carl Barus, on *Cloudy Condensation* (see bulletins and reports of the United States Weather Bureau); G. J. Symons, *The Eruption of Krakatoa* (London, 1888); H. H. Kimball, "Meteorology of the Smoke Problem," in *Monthly Weather Review*, vol. xlii, pp. 29-35 (January, 1914).

**Cosmic or Meteoric Dust.** The fact that meteors entering the earth's atmosphere from interplanetary space are burned up and disappear leads to the rational conclusion that the resulting debris must remain in the atmosphere in the shape of very fine dust, or larger particles gradually descending to the earth's surface. In many cases the cloud left behind a meteor has remained visible for a relatively long period—in some cases three or four hours—during which it changes shape and diffuses, probably being illumined by the sunlight of a distant twilight like the so-called phosphorescent clouds. In a few cases the dust collected by Nordensk-

jöld from the surface of snow has been found to contain metallic iron and nickel. In still fewer cases hailstones have had a metallic nucleus. Arago first suggested that these metallic dusts are the remnants of the shooting stars or meteors; they have therefore been spoken of as cosmic or meteoric dust, but in all cases except those of metallic iron or nickel the ordinary mineral dusts undoubtedly come from the earth itself. Many volcanic eruptions send immense volumes of dust into the air; in 1833 Krakatoa sent up 4 cubic miles of solid rock ground into impalpable dust, the finest particles of which floated about for several years. Besides the larger shooting stars and aërolites, there may well exist even the dust in the interplanetary space, some of which must frequently enter the earth's atmosphere; but except in the case of the nickel-iron compounds it seems at present impossible to distinguish such cosmic dust from that which originates on the earth itself.

**Dust Whirls and Dust Storms.** The eddies of wind, especially those on a hot summer afternoon, that form small whirls of ascending hot air, carry up leaves and dust to a considerable height. Under most favorable circumstances these may be elevated to the level of the clouds, but under ordinary circumstances they are characteristic of the driest weather and scarcely rise 1000 feet before they subside. On the hot plains of India and the western arid regions of the United States, which are subject to very high temperatures in the sunshine, the dust column becomes a very tall column, with a rapid whirling motion, having a thin hazy axis, due to the condensation of aqueous vapor in the region of low pressure that must mark the central axis. The dust storms of India have been pictured and described best by Baddeley in his book under that name, published in London in 1880. He figures not merely isolated dust whirls, but groups of many such dancing around a central region, whence they are known as "dancing devils," or remarkable combinations of many whirls into figures illustrating most complex forms of vortex motion, some of which are stable and some unstable. These are all caused by the rapid ascent and whirl of air that is heated intensely by contact with the hot soil and hot dust.

**Dust Counter.** An instrument invented by John Aitken for counting the total number of particles of dust in a small volume of air. In this instrument a definite quantity of air is suddenly and forcibly expanded, whereby it is cooled below the dew point, and immediately a fog or haze is formed within it whose density depends upon the quantity of moisture and the quantity of dust that is present. Within a short time these particles of fog descend to the bottom, falling upon a plate of black glass ruled off into small squares. With the help of a hand lens it is easy to count the number of particles per square, whence we calculate the number per cubic centimeter of air. Instead of this dust counter one may use Aitken's koniscope, in which we estimate the apparent cloudiness due to the dust. These instruments are described in his report in *Bulletin No. 11 of the United States Weather Bureau*.

The investigation of dust is an important branch of work in meteorology and in bacteriology, and the whole subject is known as koniolog. Consult: P. Hubbard, *Dust Preventives*

and *Road Binders* (New York, 1910); T. M. Prudden, *Dust and its Dangers* (2d ed., ib., 1910); Robert Hessler, *Dusty Air and Ill Health* (Indianapolis, 1912).

**DUSTAN, HANNAH** (1657-?). A heroine of the early Indian wars in New England. At the time of the attack on Haverhill, Mass., March 15, 1697 (see *HAVERHILL*), the Indians captured Mrs. Dustan and her nurse, Mary Neff, and killed the youngest Dustan child, an infant only a week old. Mrs. Dustan's husband, Thomas Dustan, with their other seven children, however, managed to escape death. The captives were assigned to an Indian family consisting of two men, three women, and seven children, and were led off towards one of the larger Indian villages. On an island (now called Dustan's Island) 6 miles above the present Concord, N. H., Mrs. Dustan and her nurse, assisted by a captive English boy, Samuel Leonardson, killed and scalped all of their captors except one squaw and a small boy. After a toilsome journey they reached their homes in safety. The story of their exploit spread rapidly, was told and retold at New England firesides for several generations, and has furnished the theme for much romance and verse. The name is also spelled Dustin and Duston. Consult Mirick, *History of Haverhill* (Haverhill, 1832).

**DUST BRAND.** See *SMUT*.

**DUSTYFOOT** (OF. *piepoudreux*, ML. *pedepulverosus*, peddler). A court of summary jurisdiction established at fairs and markets in England for the speedy determination of commercial disputes arising between those who resorted to the same. Such courts, which were common in the Middle Ages on the Continent as well as in England, were also known as courts of piepowder. See *COURT*; *LAW MERCHANT*; *PIEPOWDER*; *STAPLE*.

**DUSYANTA**, dōō-shyān'tā. In Kalidasa's drama *Sakuntalā*, the husband of the heroine. He is of the lunar race, a descendant of Paru, and father of Bharata.

**DUTCH EAST INDIA COMPANY.** A trading company composed of smaller companies which were united in 1602. Its privileges included a monopoly of trade beyond the Cape of Good Hope and the Strait of Magellan and the power of making treaties, maintaining military forces, and founding forts. Batavia, in Java, became the capital of the Dutch East Indies in 1619. During the seventeenth century the company was very powerful in the Indian Archipelago and in South Africa. Its existence was terminated in 1798. See *EAST INDIA COMPANY*.

**DUTCH EAST INDIES.** The Dutch possessions in the Malay Archipelago constituting by far the greater part of that group and lying between lat. 6° N. and 11° S. and between long. 95° and 141° E. (Map: Australasia, D 3). They consist administratively of two main divisions: (1) Java (16 residencies) and Madura (Madoera) (one residency); (2) the "outposts," or "outpost provinces" (17 provinces). The division Java and Madura is a civilized region, densely populated and completely under Dutch control. In the outpost provinces some districts are under the direct supervision of Dutch officials, while others are administered through the medium of native chiefs; still other districts refuse to acknowledge Dutch sovereignty, as Achin (Atjeh) in northern Sumatra; and some in great part are virtually unknown, as

large areas of New Guinea and of the South and East districts of Borneo. The colony, as a whole, is administered by a governor-general appointed by the crown and assisted by a council, partly legislative and partly advisory in character. The capital is Batavia, a seaport city on the north coast of western Java. The area of the 16 residencies of Java, the one residency of Madura, and the 17 outpost provinces is shown in the table below. The population figures (the latest available in 1914) relate to the end of 1905 and are probably fairly accurate for Java and Madura; for the outpost provinces they are mostly approximations, in some cases merely official guesses.

DIVISIONS	Sq. miles	Pop., 1905
Java and Madura		
Java .....	48,686	28,604,719
Madura .....	2,090	1,493,289
Outpost Provinces		
Sumatra:		
Sumatra, West Coast ..	31,788	..
Padang Highlands .....		403,431
Padang Lowlands .....		905,040
Tapanuli (Tapanoeh) ..		413,301
Benkulen (Benkoelen) ..	9,437	204,269
Lampung Districts ..	11,338	156,518
Palembang .....	53,718	796,354
Sumatra, East Coast ..	35,481	568,417
Achir (Atchir) .....	20,550	582,175
Riouw* .....	16,379	112,216
Bangka .....	4,473	115,189
Billiton .....	1,869	36,858
Java, Madura .....	56,061	450,929
Java, Madura .....	157,587	782,726
Celebes†		
Celebes .....	49,600	415,499
Menado .....	22,177	436,406
Amboina †	19,870	299,004
Ternate †	176,598	370,902
Timor .....	17,782	308,600
Bali and Lombok .....	4,063	523,535
Total .....	739,559	37,979,377

\* Consists of Indragiri in Sumatra and the Riouw and Lingga archipelagoes.

† Included in Ternate are a part of eastern Celebes island, Dutch New Guinea, and a part of the Moluccas; the rest of the Moluccas are in Amboina. Dutch New Guinea extends to 11° 11' N., with an estimated area 152,428 square miles and estimated population 262,000.

The large towns are as follows, with population at the end of 1905: Batavia, 138,551; Surabaya (Soerabaja), 150,198; Surakarta (Soerakarta), 118,378; Samarang (Semarang), 96,600; Jogyakarta (Djakakarta), 79,567; Pekalongan, 41,719 (the foregoing are in Java); Padang and Palembang, 91,440 and 60,985 respectively (in Sumatra); Bandoeng, 16,708 (in Borneo); Makassar, 26,111 (in Celebes).

The total population exclusive of Dutch New Guinea was about 37,717,000. Of these the indigenous population was 37,717,000 (Java and Madura, 28,604,719; Madura, 1,493,289); Chinese, 563,449 (295,193); "Arabs," 29,588 (19,148); other Malays, 22,970 (2842). Exclusive of Dutch New Guinea, population by religion was returned as follows (Java and Madura in parentheses): Mohammedan, 35,079,765 (29,627,557); Christian, 460,000 (26,000); Chinese and Japanese cults, 463,002 (293,844); Hindu, 170,444 (536); Animists, 789,187 (20,465); Jewish, 347 (236); other, 644,630 (67,880); total, 37,717,377 (including, in the outpost provinces, 34,139 indigenes unclassified).

In 1911 the imports of the Dutch East Indies were valued at 400,514,000 guilders and the ex-

ports at 521,600,000. Of these amounts, the private commerce, as distinguished from government, showed imports of 21,000,000 guilders and exports of 477,350,000. The share, in private commerce, of Java and Madura was 270,805,000 guilders imports and 299,863,000 exports. Value, in thousands of guilders, of the leading exports: sugar, 134,336; tobacco, 74,110; copra, 53,316; tin, 48,975; petroleum, 29,236; coffee, 25,025; tea, 13,610; pepper, 12,635; gums, 10,721; rice, 8300; hides and skins, 7445. The budget for 1913 showed estimated receipts of 273,608,208 guilders and estimated expenditure of 313,096,644 guilders. In 1913 the army consisted of 1178 officers and 31,762 men (9769 European and 21,993 native). The navy consisted of 24 vessels, aggregating 33,065 tons. See articles on separate islands and groups.

**Bibliography.** Bemmelen and Hooyer, *Guide to the Dutch East Indies* (London, 1897); Berg, *The Financial and Economical Condition of Netherlands India* (The Hague, 1895); Chailley-Bert, *La Hollande et les fonctionnaires des Indes Néerlandaises* (Paris, 1893); Cool, *With the Dutch in the East* (London, 1897); Van der Lith and Spaan, *Encyclopedie van Nederlandsch Indië* (Leyden, 1895); Cabaton, *Java, Sumatra, etc.* (New York, 1911); Walcott, *Java and her Neighbors* (New York, 1914).

**DUTCH GUIANA.** See GUIANA.

**DUTCH LANGUAGE.** Dutch is the language of the inhabitants of the Netherlands and, in a strongly marked dialectic form, of the Boers in South Africa. It was also in general use in and about New York long after the cession of the province to the English, and is still current in two or three communities in New Jersey. The name Dutch is derived from *Dietsch*, meaning the vernacular, as distinguished from Latin. It is the same word as the German *Deutsch*, with which it is sometimes confounded, as in Pennsylvania Dutch and in the ordinary speech of uneducated persons. The Dutch themselves call their language *Nederlandsch*, while in German it is called *Holländisch*. Dutch belongs to the Low Frankish division of the Low German and is very closely related to the Flemish, with which it is now practically identical in its written form. Like English, the language may be divided into three main periods: 1. Old Dutch, extending to about 1100. The only important monument of this period that has been preserved is a translation of the Psalter. 2. Middle Dutch, from 1100 to 1550. The language during this period suffered similar changes in sounds and inflections to those that can be observed in the contemporary English. As in English, no standard written form of the language was at first recognized, but each writer used his own dialect. In the thirteenth century a determined effort was made to assert the claims of a literary Dutch, the leader in the movement being Jacob van Maerlant (1235-1300). But in spite of all efforts the use of individual dialects continued. 3. Modern Dutch extends from 1550 to the present day. The most important single event in the history of the language during this period was the publication (1619-37) of the *Statenbijbel*, the authorized version of the Scriptures, which did much to spread the use of this form of Dutch in the Low Countries. The effect of this translation was similar to that of Luther's version upon High German, in establishing a standard of language and orthography that was

generally recognized as authoritative. During the eighteenth century the efforts to purify the language were carried to an absurd extent, and the language suffered greatly from the mistaken zeal of its users. During the nineteenth century a saner view of its spirit, based upon a more intelligent study of grammar and philology, has given greater freedom of expression. During the past 40 years efforts have been made to reform the orthography, and to effect uniformity of usage in Holland and Belgium, the present system having been adopted in Belgium in 1864 and in Holland in 1883.

The Dutch language is in its structure practically the same as the other members of the Germanic group of dialects. It belongs in its phonology to the Low German division, so that its consonants agree in general with the English (Dutch *te*, English *to*, German *zu*). Its orthography is somewhat awkward and does not represent the sounds of the language (e.g., *oe* = *ū*). In inflection and in syntax Dutch corresponds closely to German. It is written in the Roman alphabet and coincides in the use of capitals almost exactly with English.

The standard modern Dutch dictionary is *Woordenboek der Nederlandsche Taal*, ed. by M. de Vries, de Winkel, and others (The Hague, 1882 et seq.). For the older period of the language, Verwijs, *Middelnederlandsch Woordenboek* (The Hague, 1885-1912). The best etymological dictionary is Joh. Franck's (2d ed., 1912). Other dictionaries that deserve to be mentioned are: Verdam, *Middelnederlandsch Handwoordenboek* (ib., 1911); Dale, *Groot Woordenboek der Nederlandsche Taal*, ed. by Kuiper, Oppel, and Van Malssen (4th ed., ib., 1904); Nijhoff, *Woordenboek der Nederlandsche Taal* (ib., 1882-1913). For English students, there are Bomboff's (Arnheim, 1877), Calisch's (Leyden, 1890), and F. (The Hague, 1910). Of grammars F. (The Hague, 1910) and Ahn's (London, 1891) and Hoogvliet's (7th ed., The Hague, 1908). The best account of the language outside of Holland is Jan te Winkel's in Paul, *Grundriss der germanischen Philologie*, vol. i, pp. 419-520 (2d ed., Strassburg, 1901-09). For the pronunciation of the Dutch language, see Terneest, *Uitspraakleer der Nederlandsche Taal* (3d ed., Ghent, 1882).

**DUTCH LIQUID** (so called as being first prepared by an association of Dutch chemists), or ETHYLENE DICHLORIDE. An oily liquid obtained by passing ethylene gas into a warm mixture of 4 parts of water, 5 parts of sulphuric acid, 3 parts of common salt, and 2 parts of manganese dioxide, until the mixture assumes a yellow color, whereupon distillation yields the desired product. The mixture just specified produces chlorine, and the latter combines directly with ethylene to give ethylene chloride. Under normal atmospheric pressure ethylene chloride boils, according to Stadel, at 84.1° C. (183.4° F.). At the temperature of freezing water its specific gravity is about 1.28. It acts as an anæsthetic and has been shown to be safer than chloroform. Besides being very costly, however, it is liable to cause irritation of the throat and is therefore not used and little known. See CHLORIC ETHER.

**DUTCH LITERATURE.** The dawn of Dutch literature appears in the Middle Dutch sagas of Charlemagne and Arthur in the thirteenth century, adapted from the French epics and obviously intended for the nobility. Such

are Klaas van Haarlem's *William of Orange* (1911-1217), Dederic van Assenede's *Floris and Blanchefleur* (about 1250), an anonymous *Roland Song*, a *Gawain*, and a *Lancelot of the Lake*. *Reynard the Fox* was also done into Dutch about 1250. (See also MAERLANT.) The Dutch hymns of the thirteenth century are perfunctory, but there are folk songs and historical ballads of the fourteenth century of some merit. The general tendency in the first half of this century, here as in France, was towards commercial democracy. This appears in Maerlant (q.v.) and in his chief disciple, the moral chronicler Boendale (1280-1365), in Weert (died 1362), and Melis Stoke. With 1350 there is an aristocratic reaction, apparent before in the epics of Jan van Heelu and Hein van Aken (c. 1255-1330); but this movement expires in the early fifteenth century with Dirk Potter's *Course of Love*.

Meantime prose romance was cultivated for the vulgar, the *Old Testament* was translated about 1300, a *Life of Jesus*, the gospel story popularly rendered; and the drama, sacred and semi-profané, shows characteristic traces of the Dutch genius for low comedy. During the fifteenth and sixteenth centuries literature in the Netherlands was dominated by the literary guilds, as burgher in tone as were the Meistersingers (q.v.). These, by public festivals, popular dramas, and social influence, made literature at once democratic and conservative. A new spirit came from the renaissance of classical learning in which Dirk Coornhert (1522-90) and Houwaert (1533-99) led, and Cornelis van Ghistele (fl. 1555-83) followed, but with less effect on letters than was exerted by the Reformation, through translations of the *Psalms* (1540, 1566, 1567) and hymns (1562 and 1569), and most of all by the battle songs of liberty and bitter political scorn of the *Geusen Liederen Boeckken* (1588). The stylistic reformers of this period were the Catholic Anna Bijns (1494-1567?) and the Protestant Van Marnix (1538-98).

From the close of the sixteenth century Amsterdam becomes the literary centre, for here only is thought free. Humanism is fostered by Hendrik Spiegel (1549-1612) and Roemer Vischer (1545-1620) and by the Latin scholars Grotius, Drusius, and Vossius. In the next generation the beautiful and accomplished daughters of Visscher, Anna (1584-1651) and Tesselschade (1594-1649), poets both, were the friends, admirers, and critics of the poets of the Dutch Augustan age, Vondel (q.v.), Hooft, Huygens (q.v.). In their salon the comedies of Bredero and his rival Coster, afterward a diligent cultivator of the dramatic shudder, were first discussed, and here Starter (born 1594), an emigrant from England, introduced to the Netherlands the Elizabethan lyric (1612-14). Cats (q.v., 1577-1660) escaped at Middelburg the Visschers's genial influence; nor is it to be found in the Amsterdam Bekker (1634-98), the most philosophical of writers in Dutch.

The immediate pupils of the classical generation were the dramatists Vos (died 1667), Brandt (1626-85), Van der Goes (1647-84), and Oudaen (1628-92), the epic poet Anso (1626-69), the didactic Dekker (1610-66), Vollenhove (1631-1708), the lyric Luiken (1649-1708), and Jonctijs (1600-52). Fiction was cultivated by Heemskerk, who emulated d'Urfé in his *Batavian Arcadia* (1637) and was himself imitated by Zoeteboom (*Zaanlandsche Arcadia*, 1658) and

Bos (*Dortsche Arcadia*, 1662), while Heinsius (q.v.) preferred to imitate Le Sage (*Mirador*, 1675).

Drama by 1700 was completely Gallicized and its lyric poetry rapidly declined. The normal vehicle of the eighteenth-century thought. Here the first conspicuous figure is Van Effen, with his *Hollandische Spectator* (1731-35), and the next ones the ladies Betjen Wolff (1738-1804) and Aagjen Deken (1741-1804), who in 1780 issued *Letters on Diverse Subjects* and followed this with three novels unrivaled in Dutch literature (*Sara Burgerhar*, 1782; *Willem Leevend*, 1785; *Cornelia Wildschut*, 1792).

The first signs of the contagion of German romanticism appear in Nieuwland (1764-94), but more obviously and effectively in Bilderdijk (q.v.), though he affected to scorn it as he did Shakespeare. Feith (q.v.) showed himself an avowed disciple of Goethe, and Simons (1755-1812) of Klopstock, though Dutch realism was not without its protesting witnesses in Perponcher (1741-1819) and Van Zon (Bruno Dallberg, 1758-1818). More national in his expression of romanticism is Loosjes (1761-1818), a novelist who continues the tradition of Mesdames Wolff and Deken. . . . romantic, too, are the poets Tollens (q.v., 1780-1856), Messchert (1790-1844), and Bogaers (1795-1870), whose *Jochebed* (1835), *Voyage of Heemskerk to Gibraltar* (1836), and *Romances and Ballads* (1846) are probably the most significant Dutch poetry of his generation. Name-worthy, too, are the songs in lighter vein of Antoni Staring (1767-1840).

Since the middle of the century the achievements of Dutch scholars, especially in theology and history, deserve special recognition. The most striking novelists are Lennep (q.v.), E. D. Dekker (q.v.), and Maartens (q.v.); the best essayist, Hasebroek; noteworthy poets, Potgieter (1808-75), Nikolaas Beets (1814-1903), Pieter Genestet (1830-61), Da Costa (1798-1860), Alberdingk Thijm (1820-89), Ten Kate (1819-89), Vosmaer (1826-88), Emants (born 1848), and Louis Couperus (born 1863). Among critics are Reinier van den Brink (1810-65), Jan ten Brink, Jonckbloet, Huet, and Thijm.

About 1880 a new movement began as a part of the general European awakening. *De nieuwe Gids* was founded as the organ of the new school, which had no access to the old, conservative journal *De Gids*. The forerunners of this movement were the young lyricist J. Perk (1860-81), the celebrated M. Emants, and Helene Lapidot-Swarth. Willem Kloos, one of the foremost, issued his collected poems in 1894 and his critical essays in 1896. H. Gorter, A. Verwey, the more important F. Van Eeden, lyricist and dramatist as well as author of charming fairy tales, H. J. Boeken, the critic and novelist, K. J. L. A. Thijm (pseudonym, L. van Deyssel), E. J. de Meester, F. Netscher under French influence, A. Aletrino, Henriette R. Holst van der Schalk in socialistic novels, H. Heijermans in realistic dramas, and perhaps Steijn Streuvels in peasant stories, are among the most important. J. ten Brink has written a serviceable *Kleine Geschiedenis der Nederlandschen Letteren* (1877); Dr. Jonckbloet, a *Geschiedenis der Nederlandsche Letterkunde* (2d ed., 1873); and Van Vloten, a *Schets van de Geschiedenis der Nederlandschen Letteren* (1879). Consult: Mone, *Uebersicht der niederländischen Volksliteratur älterer Zeit* (Tübingen, 1838); Hellwald, *Geschichte der niederländischen Litteratur* (Leipzig, 1887); Kalf, *Geschiedenis der Nederlandsche Letterkunde* (Groningen, 1906); L. Schneider, *Geschichte der niederländischen Litteratur* (1887). For the new school, consult Willem Kloos, *Veertien Jaar Literatuur-Geschiedenis* (2 vols., 1880-96), and J. ten Brink, *Geschiedenis der Noord-Nederlandsche Letteren in de XIXe Eeuw* (1904).

**DUTCHMAN'S BREECHES.** See DICENTRA and Plate of BLOODROOT, in article SANGUINARIA.

**DUTCHMAN'S PIPE.** See ARISTOLOCHIA.

**DUTCH REFORMED CHURCH.** See REFORMED CHURCH IN AMERICA.

**DUTCH RUSH.** See EQUISETUM.

**DUTCH SCHOOL OF PAINTING.** See NETHERLANDS SCHOOLS OF PAINTING.

**DUTCH VERSION.** See BIBLE.

**DUTCH WEST INDIA COMPANY.** A trading company established in 1621, to which was granted monopoly of trade on portions of the American and African coasts, with the right of colonizing and maintaining military and naval forces, with which it plundered the Spanish and Portuguese settlements. It established the Dutch colonies of Brazil, New Netherlands, Guiana, the West Indies, and the Gold Coast. After its dissolution in 1674 a new company was formed which lasted until 1794.

**DUTENS**, du'tän', LOUIS (1730-1812). A French miscellaneous writer, born at Tours. After having spent his youthful years as tutor and later engaged in diplomacy, he finally settled in England, where he took Anglican orders and obtained a living of £800 and a pension. Mackenzie, the English Minister at Turin, left him £15,000. He devoted his affluent leisure to *Recherches sur l'origine des découvertes attribuées aux modernes* (1766), to an *Appel au bon sens* (1777), against the French "philosophic" vagaries of the time, and to *Considérations théologiques sur les moyens de réunir toutes les églises chrétiennes* (1798), with many archaeological treatises, and three volumes of anecdotal *Mémoires d'un voyageur qui se repose* (1806). His most valuable service to letters was a collection and scholarly edition of the *Works of Leibnitz* (6 vols., Geneva, 1769).

**DUTERTRE**, du'târtr', JEAN BAPTISTE (1610-87). A French Dominican missionary, born at Calais. For 17 years he lived in the French West Indies, and he described them and their history in a *Histoire des Antilles habitées par les Français* (1667-71).

**DUTIES.** See CUSTOMS DUTIES.

**DUTREUIL DE RHINS**, J. L. See RHINS.

**DUTROCHET**, du'trô'shâ', RENÉ JOACHIM HENRI (1776-1847). A French physiologist, born at Château de Néon (Indre). In 1808 he was appointed by Joseph Bonaparte head physician to the military hospital at Burgos, Spain, then devastated by typhus fever. He returned to France, however, in the following year and gave himself up exclusively to the study of physics and physiology. In 1831 he became a member of the Institute. The results of his researches are contained in his *Mémoires pour servir à l'histoire anatomique et physiologique des végétaux et des animaux* (1837).

**DUTT**, dût, MICHAEL MADHU SUDAN (1824-73). An Indian poet, born at Sagandari, in Bengal, India. He was educated at the Hindu College of Calcutta and, having become a Christian, at the Bishop's College. He began writing verses

in English while at Madras in 1848, but it was not until after his return to Calcutta in 1856 that he turned his attention to literary composition in his native language. Between 1858 and 1861 he produced his three classical dramas, *Sarmishtha*, *Padmavati*, and *Krishna Kumari*. The influence of the Greek and Latin epics, of Milton, and of Dante led Madhu Sudan to give up the traditional Bengali rhymes for blank verse, in which he produced *Tilottama*, and (1861) the epic which brought him recognition as the greatest Indian poet of his century, the *Meghanad-Badha*. Afterward he lived in England for a time, returning to Calcutta in 1867 to practice as a barrister.

**DUTT**, düt, TORU (1856-77). A Hindu poet, born in Calcutta. From 1869 to 1873 she studied in Europe. She translated into English the *Vishnupurana* and wrote original verse in Hindustani, French, and English. Her first volume was *A Sheaf Gleaned in French Fields* (1876). It was followed by *Le Journal de Mlle. d'Arvers*, a romance published in Paris in 1879. Her *Ancient Ballads and Legends of Hindustan* (with *Memoir* by Edmund Gosse) appeared in 1882. Consult E. W. Gosse, *Critical Kittaks* (1896).

**DUTTON**, CLARENCE EDWARD (1841-1912). An American geologist, born at Wallingford, Conn., and educated at Yale, where he graduated in 1860. He was an officer in the volunteer forces in the Civil War, after which he began his study of geology, and in 1875 was detailed to assist in Major John W. Powell's survey of the Rocky Mountains. He was connected with the United States Geological Survey in 1880-91 and in 1887 was put in charge of the division of volcanic geology and seismology. His study of the Charleston earthquake of 1886, published in the reports of that survey, attracted wide attention and helped to develop scientific interest in the study of earthquake phenomena. Of particular value was the discovery of a method for determining the depth of the focus and also his observations on the nature and speed of earthquake wave motion. He was promoted to the rank of major in the army in 1890 and retired at his own request in 1891. In 1884 he was elected to the National Academy of Sciences. His publications include: *High Plateaus of Utah* (1880); *Tertiary History of the Grand Cañon District* (1882); *Hawaiian Volcanoes* (1884); *Mount Taylor and the Zuñi Plateau* (1886); *The Charleston Earthquake of 1886* (1889); *Earthquakes in the Light of the New Seismology* (1904).

**DUTTON**, EDWARD PAYSON (1831- ). An American publisher, born at Keene, N. H. He was educated at the Boston Latin School. In 1852 he became a member of the Boston book-selling firm of Ide and Dutton, which in 1858 became E. P. Dutton & Co., with Dutton as president. In 1864 this company bought the retail business of Ticknor and Fields and later also the business of the General Protestant Episcopal Sunday School Union and Church Book Society of New York. The main business, publishing and retail, was finally concentrated in New York. One of the firm's notable enterprises has been the *Everyman's Library* (J. M. Dent, English publishers), an important series of inexpensive reprinted classics in all departments of literature.

**DUTTON**, HENRY (1796-1869). An Ameri-

can jurist. He was born in Plymouth, Conn., and graduated in 1818 at Yale, where he became professor of law in 1847. He was Governor of Connecticut in 1854-55 and from 1861 to 1866 was judge of the Superior Court and of the Supreme Court of Errors. He published an analytical digest of the Connecticut Reports in 1833, was a member of the committees of 1849 and 1866 appointed by the Legislature to revise the statutes of the State, and in 1854 was chairman of a committee which compiled the State statutes.

**DUTY OF WATER**. The ratio between a given quantity of water used in irrigation and the area of the crop to which it is applied. See IRRIGATION.

**DUUMVIRS** (Lat. *duumviri* or, more correctly, *duoviri*, from *duo*, two + *vir*, man). A committee of two; a general term in Roman administration, applicable to several officers. Most important was the function of *duoviri iure dicundo*, or 'duumvirs with judiciary powers,' the chief officers of many municipal towns. Every fifth year the duumviri exercised special censorial powers and were called *duoviri quinquennales*. In Rome there were *duoviri sacrorum* in charge of the Sibylline books, *duoviri navales* for the recruiting of the navy, etc.

**DUVAL**, du'vâl', ALEXANDER VINCENT PINEUX (1767-1842). A French dramatist, born at Rennes. In his youth he was by turn sailor, engineer, actor, and finally director of the Odéon and member of the Academy (1812). As dramatist, he is considered a good painter of the life of his time. A collection of his plays is included in his *Œuvres* (9 vols., 1822-23). Besides his plays, he wrote a romance, *Le misanthrope du Marais* (1832); *De la littérature dramatique* (1833), a critical study; *Le théâtre français depuis cinquante ans* (1838).

**DUVAL**, CHARLES ALEXANDRE AMAURY PINEUX (1760-1838). A French brother of the preceding, born at . . . was Secretary of the French Legation at Rome, and upon his return to Paris was made a member of the Institute (1811) and of the Academy of Inscriptions (1816). His principal works are: *Des sépultures chez les anciens et les modernes* (1801); *Précis de la méthode d'éducation de Pestalozzi* (1804); *Monuments des arts du dessin chez les peuples tant anciens que modernes* (1829).

**DUVAL**, CLAUDE (1643-70). A notorious highwayman. He was born in Domfront, Normandy, but went to England as a follower of the Duke of Richmond at the time of the Restoration. Here he soon took to the life of a highwayman and became famous no less for his gallantry to women than for the extent and audacity of his robberies. He was finally captured, while intoxicated, and on Jan. 21, 1670, was executed at Tyburn. His body was buried in Covent Garden Church, where a memorial was erected bearing an inscription beginning with the lines:

"Here lies Du Vall: Reader, if male thou art,  
Look to thy purse; if female, to thy heart."

Consult Smith, *Lives of the Highwaymen* (London, 1720), and Harper, *Half Hours with the Highwaymen* (2 vols., New York, 1908).

**DU VAL**, FRANÇOIS. See FONTENAY-MAREUIL.

**DUVAL**, MATTHIAS (1844-1907). A French physician and physiologist. He was born at Grasse (Alpes Maritimes) and was educated at



Strassburg, where he directed the ambulance service during the siege of 1870. Subsequently he joined the army of Bourbaki as chief of the medical staff. He was made professor of anatomy at the Ecole des Beaux-Arts, director of the anthropological laboratory of the Ecole des Hautes Etudes in 1880, and professor of histology and director of the Anthropological Institute in 1887. His more important publications (chiefly researches in anatomy and embryology) include: *Cours de physiologie* (trans. by E. Kuess, as *A Course of Lectures in Physiology*, 1876); *Précis de technique microscopique et histologique* (1878); *Manuel du microscope* (with L. Bouillet, 1873); *Manuel de l'anatomie* (with Morel); *Atlas d'embryologie* (1889); *Éléments d'histologie* (1896).

**DUVENECK, dü've-něk, FRANK** (1848- ). An American painter, sculptor, and etcher. He was born at Covington, Ky., and studied under Diez at Munich, where he lived for more than 10 years and formed a school of wide influence, composed chiefly of Americans, who accompanied him to Venice, Florence, and elsewhere on painting trips. After 1881 he spent much of his time in Florence; but he undertook the directorship of the McMicken Art School in Cincinnati. One of the first to introduce the style of the Munich school into America, he created a sensation in Boston in 1875 with five pictures, painted with unctuous brushwork and rich bituminous colors, and with much brilliancy and detail. In 1880 years his art changed in character and became lighter and cooler in color. Among his paintings are "A Circassian" (1875), a portrait of Charles Dudley Warner (1877), "The Professor" (1878), "Turkish Page and Recumbent Figure" (Pennsylvania Academy), and nine paintings in the Cincinnati Museum. At the St. Louis Exposition in 1904 he exhibited a portrait of his mother and "The Yacht Harbor." The fine monument to his wife in the English Cemetery at Florence, Italy, contains deep emotional qualities and reveals a sculptor of great ability. He was elected to the National Academy of Design in 1906.

**DUVERGIER, DE HAURANNE, dü'vâr-zhyá'de ô'ran', JEAN** (1581-1643). A French theologian. He was born in Bayonne, studied at Louvain, where Jansen was his fellow student, and in 1620 was made Abbot of Saint-Cyran. He is often called "de Saint-Cyran." In Paris he formed a connection with the influential Arnould family, and together with Angélique Arnould, directress of the Convent of Port Royal, he completely reformed that institution. He made influential enemies and was imprisoned by Richelieu at Vincennes in 1638. After Richelieu's death he was released. See JANSENISM; and consult the biography (Cologne, 1738) by Lancelot, his secretary.

**DUVERGIER DE HAURANNE, PROSPER** (1798-1881). A French publicist, born at Rouen. He was the son of Jean Marie Duvergier de Hauranne, a publicist and man of politics, and while still young collaborated with Rossi and Guizot on the *Globe* and later on the *Revue Française*. As deputy from Sancerre, he supported the views of Casimir-Périer and Thiers and became greatly opposed to the policy of his old friend Guizot. In 1848 he was elected a member of the Constitutional Assembly, and his Royalist opinions caused him to be arrested and exiled in the coup d'état that

followed. In 1852 he returned to France and wrote his *Histoire du gouvernement parlementaire en France de 1814 à 1848* (10 vols., 1857-70). For this and other writings he was elected a member of the Academy (1870). His articles contributed from time to time to the *Revue des Deux Mondes* are among the most important of his publications.

**DUVERNEY, dü'vâr'nâ', GUICHARD JOSEPH** (1648-1730). A French anatomist, born at Feurs (Loire). His notably successful lectures on anatomy in the hall of Saint-Côme in Paris secured for him an appointment in 1679 to the professorship of anatomy at the Jardin du Roi. Perhaps no other Frenchman since Riofan did so much to advance the interests of the science, especially as regards the physiology of sight and the relation between the external and the internal ear. His researches are mainly embodied in his work entitled *Traité de l'organe de l'ouïe* (1683; frequently reprinted). His works also include *Traité des maladies des os* (1751), and *Œuvres anatomiques* (1761).

**DUVERNOIS, dü'vâr'nwâ', CLÉMENT AIMÉ JEAN BAPTISTE** (1836-79). A French journalist and editor, born in Paris. He wrote considerably for various newspapers—*La Liberté*, *Le Courrier de Paris*, *L'Époque*, and others. In 1868 he founded and became editor of *Le Peuple* (from 1869 *Le Peuple Français*), a journal inspired by Napoleon III, subsidized by government funds, sold cheaply, and made an important agency in strengthening the cause of the Empire among the masses. He was in 1869 elected a deputy from Hautes-Alpes in the Corps Législatif. In 1870 he moved a vote of lack of confidence in the Ollivier cabinet, thereupon succeeded by the Palikao ministry, in which he assumed the portfolio of Commerce and Agriculture. After the revolution of the Fourth of September, he withdrew to England, but returned in 1871 and founded *L'Ordre*, an Imperialistic sheet, conducted after the fashion of *Le Peuple*. The failure for large amounts of the Territorial Bank of Spain, of which he was a director, brought upon him two years' imprisonment for fraud. He published several works on contemporary politics.

**DUVERNOY, dü'vâr'nwâ', GEORGES LOUIS** (1777-1855). A French naturalist, born at Montbeliard. He was invited by Cuvier to assist him in his work on comparative anatomy, and edited the last three volumes of Cuvier's *Leçons d'anatomie comparée*. After practicing medicine for 20 years, he was chosen professor of natural history at Strassburg in 1827, and from 1837 until his death was a professor in the Collège de France, first of natural history and afterward of comparative anatomy. His publications include *Leçons sur l'histoire naturelle des corps organisés* (1839), and *Mémoires sur le système nerveux des mollusques acéphales lamellibranches ou bivalves* (1853).

**DUVEYRIER, dü'vâ'ryâ', HENRI** (1840-92). A French explorer. He was born in Paris, studied geography and Arabic in Germany, and for a time was associated with the African traveler Heinrich Barth, in London. He subsequently returned to Paris, and devoted himself to the study of the natural sciences. He explored the northern Sahara, and finally penetrated to the centre of the Sudan. On his return he published *Exploration du Sahara: Les Tuâreg du Nord* (1864); and received from the Société de Géographie in Paris its gold medal. His



works also include *La Tunisie* (1881), and *La confrérie musselmanne de Sidi Mohammed Ben Ali-Es-Senoussi* (1884).

**DUX**, *duks* (Bohemian *Duchcov*). A town of Bohemia, situated about 18 miles west-southwest of Aussig. The castle of Count Waldstein, kinsman of Wallenstein, contains a picture gallery, a library, and many relics of Wallenstein. It has a school of mines. The town has manufactures of glass, pottery, porcelain, sugar, flour, and beer. Near by are lignite mines. Pop., 1900, 11,921; 1910, 12,399.

**DUYCKINCK**, *dr'kink*, EVERT AUGUSTUS (1816-78). An American editor, born in New York City. He was educated at Columbia College; traveled in Europe, and made early contributions to periodicals. From 1840 to 1842 he edited, with Cornelius Mathews, the monthly *Arcturus*. From 1847 to 1853, with a year's break, he edited, with his brother George Long (1823-43), the *Literary World*, an important weekly review. In 1854-55, again with his brother, he prepared the two volumes of the well-known *Cyclopædia of American Literature*, a most useful publication. A full list of his voluminous biographical works and of his literary compilations is unnecessary, but a few titles may be given: *Wit and Wisdom of Sydney Smith* (1856); *History of the War for the Union* (1861-65); *Poems Relating to the American Revolution* (1865); *Poems of Philip Freneau* (1865); *National Portrait Gallery of Eminent Americans* (1866). Consult W. C. Duyckinck, *Duyckinck and Allied Families* (1908).

**DUYCKINCK**, GEORGE LONG (1823-63). An American editor and author, born in New York City. He graduated at the University of New York in 1843; was admitted to the bar, but never practiced law; and was associated with his brother (E. A. Duyckinck) in the preparation of *The Cyclopædia of American Literature* (2 vols., 1855; 3d ed., 1875). His strong interest in all that pertained to the Protestant Episcopal church induced him to undertake a series of biographies of English clergymen of that denomination. The volumes are *George Herbert* (1858), *Thomas Ken* (1859), *Jeremy Taylor* (1860), *Hugh Latimer* (1861). Consult W. C. Duyckinck, *Duyckinck and Allied Families* (New York, 1908).

**DUYKER**. See **DUKER**.

**DUYSE**, *doi'ze*, PRUDENS VAN (1804-59). A Flemish poet, born at Dendermonde. He served as archivist in his native town, and afterward at Ghent; was a member of many learned societies in Belgium and France, and contributed greatly to the revival of Flemish literature, both by his poems and dramas and by studies in the history and literature of Flanders. He was less remarkable for genius than for fertility, though several of his productions in both prose and poetry obtained prizes from literary societies. His more important poetical publications, issued at various dates from 1836 to 1859, are: *Vaderlandsche Poezy* (Patriotic Poetry); *Natalia* (Birthday Poetry); *Elegiën*; *Gedichtjes voor Kinderen* (Poetry for Children); *Het Klaverblad* (The Cloverleaf), and *Nieuwe Kindergedichtjes* (New Poems for Children). His complete works were edited by F. de Potter (Brussels, 1861).

**DVINA**, *dvé-ná'*. An important river of north Russia, formed by the union of the Sukhona and the Jug, at the town of Veliki Ustug, Government of Vologda (Map: Russia, F 2). It flows northeasterly to its junction with the

Vitcheгда, and then, turning to the northwest, enters the White Sea by a wide estuary, about 26 miles below Archangel. Its length is over 760 miles from the source of the Sukhona and over 1100 miles from the source of the Vitcheгда. It is navigable from its junction with the Vitcheгда, a distance of over 400 miles. The basin has an area of over 140,000 square miles. The chief tributaries are the Vitcheгда, which exceeds in the volume of its waters the upper course of the Dvina, the Pinega, and the Vaga. The Vitcheгда, Jug, and Sukhona are navigated by steamers. The Dvina is connected by canals with the Volga and the Neva. The river freezes in winter, and is closed to navigation from the last week in October to the first days of May. Fish abound; the lower course of the river is the home of the navaga, a variety of cod unknown elsewhere.

**DVINA**, SOUTHERN. See **DÜNA**.

**DVOŘÁK**, *dvör'zhák*, ANTONIN (1841-1904). A famous Bohemian composer, born at Mühlausen, Sept. 8, 1841. He was to follow the occupation of his father, the butcher and innkeeper of the village, but, upon the advice of Dvořák's schoolmaster, his first teacher in singing and violin, he was sent, at the age of 12, to Zlonitz to study the piano, organ, and theory of music, and, two years later, to Kamenitz, where he remained for a year with the organist Hancke. In 1857, on his father's promise of a small allowance, he entered the organ school of the Society for Church Music at Prague. Shortly afterward the meagre pittance was cut off, and the composer had to make a living by playing the viola in small bands and cafés, until, in 1862, the orchestra of which he was a member was engaged at the newly opened Bohemian Theatre in Prague, which in 1871 became the National Theatre. Here he became acquainted with Karl Bendl, and through him first obtained access to orchestral scores of Beethoven's compositions. The study of original scores induced him to try his hand in the larger forms, and he wrote symphonies, an opera, and chamber music, though his first important work to be heard, the cantata *Die Erben des weissen Berges*, was not given until 1873. Its success was quite out of the ordinary, and the Austrian Government, after a time, granted him, for his *Sounds from Moravia*, an annual stipend of \$160, later increased to \$240. The composer now heard *Die Meistersinger*, and set out to write a comic opera, *The King and the Collier* (1874). The score proved such an unproducible monstrosity that it had to be rewritten from the first bar to the last, and then it won quite a success (1875). About this time, through the offices of Hanslick and Brahms, the judges who had awarded him the stipend, Dvořák received an order from Simrock, of Berlin, and the resulting set of *Slavonic Dances* for pianoforte duets rivaled Brahms's *Gypsy Dances* in their sudden and continued popularity. But his greatest success awaited him in England. In 1883 his *Stabat Mater*, once rejected by the Austrian Government jury, stirred up a genuine furor, and thereafter England became the home of his musical activity. *The Spectre's Bride* (cantata, Birmingham, 1885) repeated the success of *Stabat Mater*. *St. Ludmilla* (oratorio, Leeds, 1886) and the *Requiem Mass* (1891) were other works written for English festivals. In 1892 he was engaged as director of the New York National Conservatory at a salary of \$15,000 a year, a

post which he held for three years. While in the United States he grew interested in the music of negroes and Indians to the point of introducing their melodies into his symphony *From the New World*, and the overture *In Nature*. After 1895 he lived in Prague, writing in 1899 the opera *Der Teufel und die wilde Kith*. He was made an honorary member of many musical organizations, and the degree of Doctor of Music was conferred upon him by the universities of Prague and Cambridge. Later he was called to the Austrian House of Peers. Besides much chamber music, he wrote five symphonies, many sacred compositions, and a number of operas which enjoy great popularity in his native land. His pianoforte compositions are the least significant portions of his contributions to contemporary music. After his death (May 1, 1904) there were found among his papers three more completed symphonies, which were edited by his son-in-law Josef Suk (q.v.). With Smetana (q.v.) and the Young Russian School, Dvořák has called the world's attention to the inexhaustible wealth of folksongs possessed by the Slavs. While the national character of their music is not so pronounced as in the character of their musical compositions, and Dvořák among them, as a rule do not transplant the folk themes bodily, as did Liszt with the Magyar melodies. They imbue their music with the national spirit, which is most striking in rhythms and harmony; and in this line Dvořák's themes, though at times cheap in texture, carry the musician away by the sheer force of their originality and freshness. A master of orchestral color after long years of practical apprenticeship in the orchestra, Dvořák reveals his weakness when attempting to write within the boundaries of strictly classical forms, in which he had little training beyond his own studies of scores. Yet to this very independence the world is indebted for the introduction of new forms—the *Dumka* (literally a little musing, a sort of intermediary between elegy and ballad) for the slow movement, and the *Furiant* (a sharply accented Bohemian dance of vertiginous rapidity and everchanging rhythm) for the scherzo. Consult: Zibulsky, *Dvořák* (Prague, 1886); D. G. Mason, *From Grieg to Brahms* (New York, 1902); W. H. Hadow, *Studies in Modern Music*, vol. ii (New York, 1904).

**DWALE.** See **BELLADONNA**.

**DWAMISH.** See **SALISHAN STOCK**.

**DWARF** (AS. *dweorg*, *dweorh*, Icel. *dvergr*, OHG. *twerg*, Ger. *Zwerg*, dwarf). In general, an undersized (and often deformed) human being. The term is sometimes applied to the Akka (q.v.) tribe, and some other peoples in Central and Southern Africa, the Andaman Islands (see **MINOPIES**), the peninsula of Malacca (see **SEMANGS**), and the Philippines (see **ÆTA**). The dwarf tribes that are grouped around the lowest limits of human stature have always been a subject of great interest, both to laymen and to scientific men. However, the term *Pygmy* is now generally applied to people whose shortness of stature is a racial trait and not the result of pathological conditions. A large part of this interest is probably due to the widespread curiosity with regard to the abnormal, such as has from time immemorial centred in those rare departures from average height occurring among civilized races. Dwarfs, according to current terminology, are really the result of an anomaly of development, and usually manifest what are known as pathological characters.

Thus, most cases of dwarfism show traces of rickets (q.v.), which is a disorder of nutrition, where the process of ossification is arrested at a period when the bony tissue is about to become thoroughly ossified. In many instances dwarfs are well formed, and, to all appearances, perfectly normal in physical and mental characteristics. It has been observed that, in contrast with the giants, the mind of dwarfs is acute and active; in character they are often sensitive and revengeful.

Pathologically dwarfism or *microsomia* includes two classes, the pure dwarfs, miniature but well-formed people, and the common infantile dwarfs, sometimes called "type Lorain," following congenital or acquired diseases.

Dwarfism as seen in Europe and the United States is due in a large majority of cases to cretinism (q.v.) or infantile myxedema. This is a disease of the thyroid gland. The cretin dwarf is abnormal mentally as well as in physical proportions. The head is relatively large, the lips thick, the skin and hair coarse, the spine bent, and pelvis deformed. Mentally he is inferior and may be idiotic. Other diseases resulting in dwarfism are Mongolian idiocy, achondroplasia (characterized by great shortening of the extremities), severe types of rickets, and spinal tuberculosis.

Formerly dwarfs were attractions in the entourage of kings; since then they have generally been exhibited for gain. Perhaps the most remarkable of these little folk is the feminine dwarf Hilany Agyba, of Sinai, 15 inches in height. The height of the celebrated Bébé of King Stanislas, of Poland, was 89 centimeters; another, 25 years of age, and 56 centimeters in height, was presented to Henrietta of France in a pie. The hunchback dwarfs of Philip IV were immortalized by the great Spanish painter Velazquez. Topinard has observed dwarfs that weighed as low as from 4 to 8 kilograms. The infrequency of dwarfs among the lower races of mankind is probably due to natural selection, as well as to the custom of destroying abnormalities.

Stories of dwarfs, brownies, elves, etc., are familiar in the folklore of nearly every tribe on earth, though the greatest development of these myths seems to be among the peoples of Aryan descent. Lately a theory has been advanced that the belief in brownies in England is a survival from ancient times, when a small, dark race of aborigines inhabited the country, and that the folk tales have an actual basis of fact. See **PYGMIES**.

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**DWARF LEMUR.** One of four species of small. seminocturnal lemurs inhabiting Madagascar, belonging to the genus *Microcebus*. They

live in the highest trees and make a nest of dried leaves, sometimes on a branch or again in a hollow tree. The food consists of fruit and insects, especially butterflies and moths. See CHIROGALE.

**DWARF SNAKE.** Any of a large variety of



DWARF SNAKE (*Carphophiops vermis*).

(Top, face, and side view.)

small, slender, seclusive serpents, forming the colubrine group Calamariinae, and represented in the warmer parts of the whole world. The typical genus, *Calamaria*, belongs to the East Indies, where these snakes are numerous under logs and in similar hiding places and form a considerable part of the food of other snakes. Several genera and numerous species are to be found in tropical America and Mexico; and one species, *Haldea striatula*, usually included in this group, though considered by Cope a nearer ally of the water snakes (*Natricinae*), is common in the southern United States. It is a pretty little creature, about the size and shape of a lead pencil, brown above and yellow or reddish beneath, with a chestnut band across the head. It hides from view, lives upon insects, and is perfectly harmless. The representatives of the calamarine dwarf snakes in the United States belong to the genus *Carphophiops*, or *Carphophis*, several species of which occur in the warmer half of the country, inhabiting rotten logs and similar hiding places. The general colors are glossy brown above and yellowish or salmon color below. They feed upon earthworms, the pupæ of ants and soft-bodied grubs, and often make their home under half-rotten bark. They are oviparous and deposit a few eggs late in July. The newly hatched young are  $3\frac{1}{2}$  inches in length and less than  $\frac{1}{8}$  of an inch in diameter.

**DWARKA**, dwār'kā. A town of Baroda state, India, on the Arabian Sea, on the west side of the Kathiawar Peninsula, 270 miles west of Baroda City (Map: India, A 4). It is celebrated as the birthplace and residence of Krishna, to whom the great temple of Dwarakanath is here dedicated. It is a resort for Hindus, over 10,000 pilgrims visiting the shrine annually. Pop., 1901, 7535; 1911, 6548.

**DWELSHAUVERS-DERY**, dvēl'zō'vâr'-dā'rē', VICTOR (1836- ). A Belgian engineer and physicist, born at Dinant. He was educated at the universities of Brussels and Liège and obtained the chair of engineering at the latter institution in 1869. He was the commissioner of the Belgian government at several international expositions. His writings are devoted chiefly to the regulation of machinery and to the theory of heat engines. He has reduced the modern theory of steam energy to exact figures, basing his calculations largely upon the calorimetric methods of Hirn. His publications include: *Le monde ou nous vivons* (trans. by Anstey, 1871); *Principes de la résistance des matériaux* (1878); *Exposé succinct de la théorie des moteurs à vapeur* (1880-82); *Etude expérimentale thermique de la machine à vapeur* (1892); *Etude expérimentale calorimétrique de la machine à vapeur* (1894).

**DWERNICKI**, dvr̄-nits'kē, JOZEF (1779-1857). A Polish general, prominent in the

revolution of 1830-31, born in Warsaw. In 1826 he became a Russian general of brigade. Upon the outbreak of the revolution of 1830-31 he was appointed to organize the Polish cavalry service and on Feb. 14 and 19, 1831, defeated the Russians at Stoczek and Nowawicz. He was subsequently taken prisoner by the Austrians and deported to Hungary, where he resided under surveillance. His *Pamiętniki* (Memoirs) were edited by Plagowski (1870).

**DWIGHT**, BENJAMIN WOODBRIDGE (1816-89). An American educator and author. He was born in New Haven, Conn., and was educated at Hamilton College, New York, and at Yale Theological Seminary, where he graduated in 1838. In 1846 he founded the Congregational church at Joliet, Ill., and, after acting for two years as its pastor, removed to Brooklyn, N. Y., where he established the Dwight High School, which he conducted for 12 years. From 1858 until 1867 he conducted similar schools at Clinton, N. Y., and in New York City. His publications include: *The Higher Christian Education* (1859); *Modern Philology* (1864); *History of the Dwight Family in America* (1874); *Woman's Higher Culture: The True Doctrine of Divine Providence* (1887).

**DWIGHT**, EDMUND (1780-1849). An American merchant. He was born in Springfield, Mass., graduated at Yale in 1799, and studied law with Fisher Ames. The manufacturing firm which he established in Boston founded Chicopee Falls in 1822, Chicopee in 1831, and Holyoke in 1847. Dwight was instrumental with Horace Mann (q.v.) in establishing the Massachusetts State Board of Education and the present normal-school system of the State.

**DWIGHT**, HARRISON GRAY OTIS (1803-62). An American Congregational missionary. He was born at Conway, Mass., graduated at Hamilton College in 1825, studied theology at Andover, and was afterward sent by the American Board to assist in the Armenian missions. Among his works are: *Christianity Revived in the East* (1850) and a "Catalogue of Armenian Literature in the Middle Ages," in the *Journal of the American Oriental Society* (Boston).

**DWIGHT**, HENRY OTIS (1843- ). An American Congregational missionary, born in Constantinople, Turkey, the son of H. G. O. Dwight. He entered Ohio Wesleyan University, but left in 1861 to serve in the Civil War. He was treasurer of the Northampton (Mass.) Street Railway Company (1866-67) and business agent at Constantinople of the American Board of Commissioners of Foreign Missions (1867-72), edited missionary publications in the Turkish language for seven years, and from 1875 to 1892 was also Constantinople correspondent of the *New York Tribune*. Meanwhile (in 1880) he had been ordained to the ministry. After resigning his commission as a missionary in 1901 he was connected prominently with various missionary and Bible societies in the United States. He edited *Report of the Ecumenical Conference on Foreign Missions* (1900) and the *Encyclopedia of Missions* (1904) and wrote *Turkish Life in War Time* (1881); *Treaty Rights of American Missionaries in Turkey* (1893); *Constantinople and its Problems* (1901); *Blue Book of Missions* (1905; 2d ed., 1907); *A Moslem Sir Galahad* (1913; 2d ed., 1914). He contributed to the NEW INTERNATIONAL ENCYCLOPÆDIA.

**DWIGHT, JOHN SULLIVAN** (1813-93). An American music critic, born in Boston, Mass. While at Harvard (class of '32), he aided in founding the Harvard Musical Association, of which he was president for many years. He became a Unitarian minister, but later joined the Brook Farm Community, where he was musical editor of the *Harbinger*. In 1852 he founded *Dwight's Journal of Music*, which he conducted with such ability and consistency of purpose that at one time it enjoyed wide influence. Dwight was, however, a classicist and unable to keep up and sympathize with the tendencies of modern music, especially with Wagner. The *Journal* gradually lost its circulation, and in 1881 it was discontinued.

**DWIGHT, JONATHAN, JR.** (1858- ). An American physician and ornithologist, born in New York City. He graduated from Harvard University in 1880 and from the College of Physicians and Surgeons of Columbia University in 1893. From 1894 to 1904 he was assistant surgeon in the department of laryngology at the Vanderbilt Clinic. In 1886 he became a fellow, and in 1905 treasurer, of the American Ornithologists' Union; and he served as president of the Linnæan Society.

**DWIGHT, NATHANIEL** (1770-1831). An American physician. He was born in Northampton, Mass., and was the brother of the elder Timothy Dwight, president of Yale. He was probably the first to propose the present system of retreats for the insane, and his *Short System of the Geography of the World* (1795; rev. ed., 1814) was the first school geography published in the United States. He also wrote *A Compendious History of the Signers of the Declaration of Independence* (1831).

**DWIGHT, SERENO EDWARDS** (1786-1850). An American clergyman and writer, a son of President Timothy Dwight, of Yale. He was born at Greenfield Hill, Conn., graduated at Yale in 1803, studied and practiced law, and afterward devoted himself to the study of theology and was pastor of the Park Street Church, Boston, 1817-26. From 1833 to '1835 he was president of Hamilton College. He published the *Life of David Brainerd* (1822); the *Life and Works of Jonathan Edwards* (his great-grandfather) (10 vols., 1830); and a volume entitled *The Hebrew Wife* (1836), written to prove the unlawfulness of marrying a deceased wife's sister. Consult *Select Discourses*, with a memoir by his brother, William Theodore Dwight (New York, 1851).

**DWIGHT, THEODORE** (1764-1846). An American lawyer and journalist. He was born at Northampton, Mass., and was the brother of Timothy Dwight, president of Yale, and the grandson of Sereno Edwards. He was a distinguished lawyer and a leader of the Federalist party, was a member of Congress in 1806-07, and was secretary of the famous Hartford Convention in 1814. His talent as a writer made him a brilliant editor in turn of the *Hartford Mirror*, the *Albany Daily Advertiser*, and the *New York Daily Advertiser*, which he founded in 1817. Among his publications are *Life and Character of Thomas Jefferson* (1839), and *A History of the Hartford Convention* (1833).

**DWIGHT, THEODORE** (1796-1866). An American author. He was born in Hartford, Conn., the son of Theodore Dwight (1764-1846), graduated at Yale in 1814, and devoted himself to editorial work on various papers and maga-

zines, besides taking an active interest in the work of Sunday schools. Among his publications are: *Tour in Italy* (1821); *The Northern Traveler* (1825; 6th ed., 1841); *First Lessons in Modern Greek* (1833); *The Roman Republic of 1849* (1851); *History of Connecticut* (1841); *The Kansas War: or, the Exploits of Chivalry in the Nineteenth Century* (1859).

**DWIGHT, THEODORE WILLIAM** (1822-92). An American jurist of distinction. He was born at Catskill, N. Y., graduated at Hamilton College, and afterward studied law at Yale, and was professor of law in Hamilton College, where he established a school of law. In 1858 he was appointed professor of municipal law in Columbia College and became the founder of the law school of that institution and administered it as warden till his resignation in 1891. He was deservedly famous as a law teacher of remarkable lucidity and persuasiveness. In 1868 he became nonresident professor of constitutional law in Cornell University and in 1869 lecturer in Amherst College. He was a member of the New York Constitutional Convention in 1867 and in 1874 became a member of the Commission of Appeals, a court created by act of the Legislature to relieve the congestion of the Court of Appeals; was president of the New York Prison Association; and was an active member of the well-known "Committee of Seventy" of New York City. His publications include *Trial by Impeachment* (1867), *Argument in the Rose Will and Charity Cases* (1863), and papers reprinted from the *American Law Register*, of which he was an associate editor. With Dr. E. C. Wines, the eminent penologist, he also published *Prisons and Reformatories in the United States*, and he edited Maine's *Ancient Law* (New York, 1864).

**DWIGHT, TIMOTHY** (1752-1817). An American clergyman and educator. He was born at Northampton, Mass., graduated at Yale College in 1769, was a chaplain in the army during the Revolutionary War, pastor and principal of a well-known boys' school at Greenfield, Conn., from 1782 to 1795. In the latter year he was chosen president of Yale College and filled the position till his death, Jan. 11, 1817. His *Travels in New England and New York* (1821) is important for historical purposes. His *Theology Explained and Defended* (1818) is an important work in the development of the New England theology. Consult his memoir by his son, Sereno E. Dwight, the latter's edition of his *Theology* (New York, 1846).

**DWIGHT, TIMOTHY** (1828- ). An American clergyman and educator, born at Norwich, Conn. He graduated at Yale in 1849, studied at Yale Divinity School, and in 1856-58 at the universities of Bonn and Berlin; in 1858 was appointed professor of sacred literature and New Testament Greek and Exegesis in Yale Divinity School, and in 1861 was ordained to the ministry of the Congregational church. In 1886 he was elected president of Yale; his grandfather, Timothy Dwight, had been president of Yale in 1795-1817. He resigned this office in 1899. During his administration Yale took the title of university and assumed proper status as such. He was particularly successful in obtaining the numerous gifts and endowments necessary to an increase in equipment. In 1878-85 he was a member of the American Committee for the Revision of the English Bible. From 1866 to 1874 he was an editor of the *New*

*Englander* (later the *Yale Review*), in which he published, in 1870-71, a series of articles on "The True Ideal of an American University." He wrote also annotations to the English translation of the volumes "Romans," "Timothy-Philemon," "Timothy-Hebrews," and "James-Jude," in Meyer's *Kritisch-exegetischer Kommentar zum neuen Testament* (Göttingen, 1832 et seq.); a translation of Godet's *Commentaire sur l'évangile de St. Jean* (Paris, 1864-65); an *Address Delivered at the Funeral of President Porter* (1892); a *Commemorative Address* in honor of W. D. Whitney and J. D. Dana (1895), sermons entitled *Thoughts of and for the Inner Life* (1899); *Boston at the Beginning of the 19th Century* (1903); *Memories of Yale Life and Men* (1903).

**DWIGHT, WILLIAM BUCK** (1833-1906). An American geologist and naturalist, born in Connecticut, son of Harrison Gray Otis Dwight, the American missionary (q.v.). He came to this country in 1850 and graduated at Yale (1854), Union Theological Seminary (1857), and Sheffield Scientific School (1859). After two years (1865-67) spent in examining West Virginia mines he entered educational work. He was principal of the officers' family school at West Point from 1867 to 1870 and in 1894 was appointed one of the two university examiners for New York State. In 1878 he was appointed professor of natural history and curator of the museum at Vassar College. His most important work as a geologist included investigations of the Cambrian and Ordovician stratigraphy and geology of the Hudson River and Dutchess Co., N. Y., and the limestone district of the Catskill valley. He became a frequent contributor to geological papers, but the results of much of his more important paleontological work are still unpublished. Professor of geology in the department of geology in the *Standard Dictionary*. He invented the "petrotome," a machine for cutting thin sections of minerals and fossils.

**DYAK, or DAYAK.** A general name applied by the Malay invaders to the peoples inhabiting the interior and a considerable portion of the coast of the great island of Borneo, who seem to be its aborigines. Physically and linguistically they all belong to the Malayan race, but there are numerous variations from the characteristic type. Dyak culture runs all the way from the savagery of the mountainous interior to the civilization of the coast, where, under Javanese, Bugi, and Chinese influences, the artistic and industrial abilities possessed more or less by all the tribes are seen to better advantage, and many states and sultanates have from time to time flourished. The Dyaks have taken to Islam less kindly than their kindred, the Malays proper, and some of the uncivilized tribes of the interior probably preserve traits of original Malayan heathenism, elsewhere lost. Intellectually, morally, and socially the Dyak at his best is perhaps superior to the typical Malay, as he also exceeds him in stature and often in good looks. The Dyaks are also less restrained and more given to physical exercise than the Malays proper. The paddle, the spear, the blow gun, bamboo bridges, cloth weaving, and metal work represent some of the outcrops of Dyak genius. Among the more savage Dyak tribes are the Olo-ut of the central interior; the Punan, farther to the northeast; the Kayans; the Kenyas; the Bahau; Segai, etc. Of these

the Punan (including the Ukits and a few closely allied minor groups) are the only people who do not cultivate rice and do not make boats. They support themselves by hunting and gathering wild jungle fruits. Except for basketry and matting, nearly all their manufactured articles are secured from the other tribes. Thus, they represent the crudest culture of the natives of Borneo. The Milanos about the Redjang River; the Land Dyaks; the Sea Dyaks of Sarawak, Brunei, etc.; the Dusun (Idaan) of the northeast, are all more or less civilized. Some of the Dyaks take well to agriculture; and head hunting and cannibalism, for which the Dyaks were once so famous, are rapidly disappearing. The traditional home of the Dyaks is in the mountains of the central interior, from which the so-called "Sea Dyaks," once famous as pirates, have wandered farthest. The results of the Haddon exploring expedition of 1898-99 have added much to our knowledge of the tribes of the interior. Besides the general works on Borneo, consult: Bock, *Head Hunters of Borneo* (London, 1881); Klein, *Die bildenden Künste bei den Dayaks auf Borneo* (Vienna, 1890); Roth, *The Natives of Sarawak and British North Borneo* (London, 1896); W. H. Furness, *The Home Life of Borneo Head-hunters* (3d ed., Philadelphia, 1902); Edwin H. Gomes, *Seventeen Years among the Sea Dyaks of Borneo* (Philadelphia, 1911); A. W. Nieuwenhuis, *Quer durch Borneo* (2 vols., Leiden, 1904); Hose and McDouall, *The Pagan Tribes of Borneo* (2 vols., London, 1912).

**DYAS.** See PERMIAN SYSTEM.

**DYAS, ADA** (?-1908). An Irish actress, both of whose parents were on the stage. She made her London début in 1861 in *Henry IV*. She created the part of Phoebe in Robert's *Lady Audley's Secret* and that of Clara in *Hunted Down* (1866), and she was selected by Wilkie Collins himself to play the double rôle of Anne and Laura in *The Woman in White* (1870). Her first American appearance was under the management of Augustin Daly in 1872 at the Fifth Avenue Theatre, New York, in *Man and Wife*. Later, at Wallack's, her most successful rôles were those of Kate Hardcastle, Lady Teazle, Lady Gay Spanker, Lydia Languish, and especially that of Claire Ffolliott in Boucicault's *The Shaughraun*. She toured as Esther Eccles in *Caste* and subsequently as Mrs. Ralston in *Jim the Penman* and as Mrs. Seabrooke in *Captain Swift*. In 1892 she played Goneril in Sir Henry Irving's revival of *King Lear* at the London Lyceum.

**DYCE, ALEXANDER** (1798-1869). An English scholar and critic, born in Edinburgh. He was educated at the high school of that city, and at Exeter College, Oxford. After officiating for some time as curate, he settled in London in 1825. His literary reputation is chiefly based on his editions of the older English poets and authors—George Peele, Robert Greene, John Webster, Shirley, Thomas Middleton, John Skelton, Beaumont and Fletcher, Ford and Marlowe, with biographies of the authors and instructive notices. He also edited the poems of Shakespeare, Pope, Akenside, and Beattie, for Pickering's Aldine Edition of the Poets. Two old plays discovered by him, called *Timon* and *Sir Thomas More*, were published by the Shakespeare Society. In conjunction with Collier, Halliwell, and Wright, he founded the Percy Society for the publication of old English bal-

lads, plays, and poems. His ability as a commentator on Shakespeare is proved by his *Complete Edition of the Works of Shakespeare; the Text Revised; with Account of the Life, Plays, and Editions of Shakespeare, Notes, etc.* (1857). The *Glossary* to this edition, in its day the best and largest—a volume of 500 pages—was issued (New York, 1902) as *General Glossary to Shakespeare's Works*.

**DYCE, WILLIAM** (1806-64). A Scottish historical painter. He was born in Aberdeen, Sept. 19, 1806, the son of a distinguished physician. At the age of 16 he graduated from Aberdeen University with the degree of M.A. and went to London to study painting at the Royal Academy. He made two visits to Rome, in 1825 and in 1827, and during the second developed strong Pre-Raphaelite tendencies, his work meeting with the enthusiastic approval of Overbeck and the Nazarene painters. Not finding his Madonnas appreciated on his return to Aberdeen, he devoted himself to scientific pursuits and afterward to portrait painting, in which he succeeded especially well with women and children. He settled in London in 1830 and was made associate of the Royal Academy in 1835. His pamphlet upon the application of design to manufactures, in 1837, led to his appointment as superintendent of the School of Design, then recently established at Somerset House, London, and the publication of his report upon French and German schools of applied art, in 1840, resulted in the reorganization of the London school and the establishment of provincial schools in accordance with his ideas. In 1844 he was made professor of fine arts in King's College, London, and in 1848 a member of the Royal Academy.

In the competition for the frescoes of the new Houses of Parliament, held in 1844, Dyce was one of the successful competitors. His "Baptism of Ethelbert," in the House of Lords, was deemed so successful that the other artists were instructed to adapt their design and coloring to his. He executed for the Prince Consort, at Osborne, an impressive fresco, "Neptune Giving the Empire of the Sea to Britannia," and was intrusted with the decoration of the Queen's robing room at Westminster. The subjects, which he himself had suggested, were from the legend of King Arthur, typifying "Chivalry," and the five which he lived to finish are his masterpieces. He died in London, Feb. 14, 1864.

Dyce's art represents a revolt from the eclectic principles of the Academy, similar to that more definitely inaugurated at a later period by the Pre-Raphaelites. It is refined and tasteful, but rather a learned art than one which appeals to the senses. It resembles that of the Nazarenes, except that the color is better. Besides the frescoes mentioned above, among his chief paintings are "Bacchus Nursed by the Nymph" (1827); "Joash Shooting the Arrow of Deliverance" (1844); "Madonna and Child" (1846, Royal Academy); "Meeting of Jacob and Rachel" (1850, Hamburg Kunsthalle). He also designed some fine cartoons for stained-glass windows in Ely Cathedral and other churches. The National Gallery of Scotland contains a number of his pictures. He was deeply learned in theology and patristic literature and one of the leaders of the "High Church Movement." He was also a fine organist and the composer of anthems. For a publication of the Book of Common Prayer, set to the

ancient music, he received the Prussian gold medal of science and art. He also published numerous pamphlets on art.

Consult the article "William Dyce," in the *Dictionary of National Biography* (London, 1888), and in Redgrave, *Dictionary of Artists in the English School* (ib., 1878).

**DYCK, DIK, VAN.** See VAN DYCK.

**DYEA**, *dé'a* or *dí'a* (American Indian, pack, load). Formerly a village in the southern district of Alaska, on Chilkoot Inlet, the east fork of Lynn Canal (Map: Alaska, N 6), and at one time important as a starting point for the upper Yukon and the gold fields of the Klondike; but it has been outstripped by Skagway (q.v.), owing to the opening of the White Pass and Yukon Railroad. The Dyea, or Chilkoot, route began at Dyea.

**DYEING** (OF. *dyen*, to dye, AS. *dēagian*, from *dēag*, color; connected with AS. *dēaw*, dew). The art by which various substances, especially textile fibres, are colored with coloring matters with sufficient fastness to resist the action of light, water, or ordinary wear.

**History.** The art of dyeing was practiced in some form by all primitive peoples. It is mentioned in the Bible that Jacob gave his favorite son Joseph a coat of many colors, and Moses tells how the skins of the ram and the badger used in the tabernacle were dyed red. The so-called Tyrian purple was known in the early days of the Roman Empire. It was such an expensive dye that the Emperor and the Imperial family were practically the only users of it, which gave rise to the expression "born to the purple." By an edict of the Emperor Diocletian, issued 301 A.D., the price of wool well dyed with this color was fixed at the equivalent of \$350 in gold per pound. According to Pliny, the purple color was derived from certain shellfish, a species of snail, found along the coast of Phoenicia. In time the shellfish became almost exterminated, and by the Middle Ages the dye had been lost to commerce. Recently a German color chemist, Dr. Friedländer, collected a sufficient number of the shellfish, which are still to be found along the shores of the Mediterranean, to extract the coloring matter and analyze it. It proved to be a combination of indigo and bromine. Neither the natural color nor its synthetic reproduction is of present-day importance. Pliny is also the authority for the statement that methods of dyeing black, yellow, and green were brought into Greece from India on the return of Alexander the Great. Some dyes probably of Indian origin are indigo, similar to the wood which Julius Cæsar found in use among the Britons; turmeric, or Indian saffron; cutch; and gambier. Towards the close of the Middle Ages the art of dyeing was greatly developed in northern Italy, especially in Florence, where the dyestuff archil (q.v.) was discovered about 1300. The early voyagers to America brought back with them new and valuable dyestuffs, such as cochineal, logwood, quercitron, and fustic. Subsequently dyeing developed according to the discoveries of new dyestuffs such as the mineral dyes, and the application of improved processes, until 1856, when the first artificial dyestuff, mauve, was discovered by William Henry Perkin in experimenting with aniline. Many aniline colors and other coal-tar dyes followed, until now dyes of this class have almost entirely superseded the natural dyestuffs. (See COAL-TAR COLORS.) The

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most important natural and artificial coloring matters may be found described in articles under their special names. Mineral and vegetable dyes were formerly considered more lasting than the artificial ones, but this view has in most cases positively no foundation in fact. The accompanying table shows which artificial substances have either partly or completely displaced natural ones in the dyeing of animal and vegetable fibres.

Dyestuffs may be divided into "basic colors," which dye vegetable fibres only after the use of an acid mordant, and "acid dyes," which require basic mordants for the same fibres. Both classes dye animal fibres direct without a mordant. A newer class known as "substantive dyes" can be used with both vegetable and animal fibres without ..... Most of the older aniline dyes be ..... first class; alizarine and sulphurated dyes to the second class; the newer azo dyes to the third class. (See *Azo Colors*, under the article COAL-TAR COLORS.) Based on their methods of application, most of the dyestuffs used at the present time fall into the following classes: acid, basic, substantive, mordant, after-chromed, developed, naphthol, coupled, sulphur, indigo or vat, oxidized, and mineral pigment dyes.

**Mordants.** These are substances capable of combining with other substances (the commercial dyestuffs) to form insoluble colored compounds. Thus, aluminum salts make an insoluble red compound with alizarin and are therefore used as mordants in calico printing. Ferric salts make, with alizarin, an insoluble dark purple compound and are likewise employed as mordants in calico printing. Soluble mordant salts must themselves be transformed into insoluble compounds before they are allowed to form the dyes in order to prevent the mordanting material from being dissolved out of the fabric when the latter is introduced into the dye bath. Therefore, after the fabric has become impregnated with the soluble mordant salt, it is treated with ammonia, lime, or hot steam—with a view to transforming the soluble salt into an insoluble hydroxide or an insoluble basic salt; or else the fabric is treated with sodium phosphate or sodium arsenate—with a view to transforming the soluble salt into an insoluble phosphate or arsenate. In the case of animal fibres the same end is often attained by simply immersing the fabric in a boiling dilute solution of the soluble salt, the insoluble mordant being then deposited in the fibre directly. The fabric containing the insoluble mordant is ready to be treated with the dyeing substance, the resulting color of the fabric being evidently that of the compound formed by the latter with the mordant. Another method of dyeing with the aid of mordants, extensively employed in calico printing, consists in mixing the dye directly with the soluble form of the mordant and with starch, dextrin, gum, or some other thickening substance. .... mixture on the fabric, and ..... the latter to a process of steaming. The result is of course the same as in case the other methods are employed; for the steaming process has the effect of transforming the soluble into an insoluble form of the mordant, the latter then combining with the dyeing substance. Mordants may be either basic or acid—the former combining with "acid dyes," the latter with "basic dyes." The mordants mentioned above are

basic, and their compounds with dyes are termed "lakes." Among the acid mordants may be mentioned tannin, or tannic acid. After the fibre has been impregnated with this mordant in its ordinary, soluble form, it is passed through a weak solution of chloride of tin or of tartar emetic. These produce respectively the tannate of tin or the tannate of antimony (tartar emetic is a compound of antimony), and these insoluble tannates further combine into insoluble colored compounds with dyes.

**Theories of Dyeing.** The question as to whether dyeing involves true chemical combination of the fibres with the dyestuffs or not has not yet been definitely answered. Some investigators believe that dyed fibres are merely mechanical mixtures; others hold that dyed fibres are true chemical compounds; finally, still others hold that they constitute what are now termed "physical mixtures," or "solid solutions." Those who accept the chemical theory argue that if the dyestuff did not combine chemically with the fibre, then there would be no reason why chemically neutral-colored substances should not act as dyes; yet true dyes are generally either acid or basic, while the fibres themselves may be either basic or acid, or else may include both basic and acid constituents. Another argument in support of the chemical theory is found in the fact that some substances, while themselves colorless, are capable of imparting color to fabrics when directly applied to them; the view being that colored substances must be transformed chemically in order to produce color. The principal arguments in favor of the "physical mixture" theory, advanced by O. N. Witt in 1890, are as follows: 1. Solid fuchsin is green, with a metallic lustre; solutions of fuchsin are colored red; and fabrics dyed with fuchsin are likewise colored red. 2. Solid rhodamine shows no trace of fluorescence; its solutions are fluorescent; and silk dyed with rhodamine likewise shows distinct fluorescence. The fact that the same dyestuff may impart different colors to different fabrics is compared with the fact that iodine gives different colors in different solvents, and yet there is no reason for assuming that iodine forms chemical compounds with its ordinary solvents. Finally, in accordance with Witt's theory, the function of mordants is explained by the assumption that solutions of these substances in fibres are much better solvents for the dyestuffs than are the pure fibres. However, while interesting because capable of development and quantitative verification, this physicochemical theory is yet far from being definitely established or generally accepted by chemists.

**Dyeing Processes.** Cotton, silk, artificial silk, and wool are the textile fibres that are usually subjected to processes of dyeing. Before dyeing, the fibres are first cleaned so as completely to remove all natural and artificial impurities, such as grease and dirt, which tend to produce spots or uneven shades of color, in consequence of improper fixing of the mordant and color. Whenever light and delicate tints are to be dyed on the fibre, bleaching becomes necessary. The preliminary steps in the preparation of cotton include boiling the fibre in a weak solution of caustic lye, after which it is rinsed and then steeped in a solution of bleaching powder and again rinsed. A further step consists in steeping it in dilute sulphuric, hydro-

chloric, or acetic acid, after which it is again cleansed by washing, and dried. Silk is boiled in soap solution in order to remove the natural silk glue which accompanies the crude fibre and is then bleached either by exposure to sulphurous acid fumes produced by burning sulphur or by the use of the peroxides of hydrogen and sodium. Wool is cleansed by washing in warm soap solution, frequently combined with sodium or ammonium carbonate, by means of which the natural grease of the fibre is removed. It is then bleached with sulphur dioxide.

**Apparatus.** The apparatus of the dyer is very simple, consisting of vats, kettles, and cisterns, which may be of wood, stone, or metal. In Europe the kettles are still heated over open fires, but in America a steam coil is universally used. A pure water supply is absolutely essential to successful dyeing. When the available water supply is contaminated by sewage or the water is hard because of lime salts, artificial purification must be employed. Suspended matter may sometimes be removed by sedimentation or filtration, or the two combined, but chemical treatment may be required to remove these and other impurities.

Dyeing may be done in various stages of fabric manufacture, depending upon the material and the purpose for which it is intended. Some of the methods employed are:

1. *Raw-Stock Dyeing.*—This is also known as dyeing in the wool. The wool is dyed after scouring, and after bleaching if the latter is necessary, but before it is carded or spun. The dye penetrates the fibre well, giving a permanency of color desirable in garments destined for hard wear. In the Oxford mixture the black is generally dyed in the wool.

2. *Dyeing in the Slub.*—The slub, or top, is the soft rope of fibres formed in the processes preparatory to twisting and spinning. Dye-stuffs penetrate it readily. A special machine is in use which prints the dye upon the slub at regular or irregular intervals. Later drawing and twisting give a well-mixed effect to the yarn. Such yarns are used for the Vigoureux mixture.

3. *Skein Dyeing.*—The yarn is dyed in the skein. Gingham and woolen plaids are skein dyed.

4. *Piece Dyeing.*—The material is dyed after weaving.

5. *Cross Dyeing.*—This method is applied to wool and cotton mixtures. Dyes are used for wool which are fugitive on cotton; therefore the wool takes the dye, and the cotton remains unchanged. White hair-line or check effects are produced in this way. If a single color is desired, the cotton is dyed first to the right shade, then the material brought up to uniform color in a wool bath.

6. *Resist Dyeing.*—This is a form of cross dyeing. Certain yarns, or parts of fabrics, are treated to resist the dye which colors the remainder of the material. The Javanese employ this method in their Batik work.

7. *Discharge Dyeing.*—By the use of chemicals the color is discharged from dyed material, in polka dot or other pattern effects.

In all dyeing operations considerable attention must be paid to the permanency of the dye used. Dyes may be fast to light, to washing, or to both. The choice of dyestuff as to fastness is determined by the purposed use of

the material to be dyed. A color is considered fast to light if it does not fade with four weeks' exposure to the sun; moderately fast if only a slight fading is observed after three weeks, and fugitive if it fades in one week.

**Bibliography.** The literature of dyeing is very extensive, and reference should be had to the articles in the various technical cyclopædias as well as to the following works: Crookes, *A Practical Handbook of Dyeing and Calico-Printing* (London, 1874); Hurst, *Silk Dyeing, Printing, and Finishing* (Glasgow, 1892); Knecht, Rawson, and Lowenthal, *A Manual of Dyeing, for the Use of Practical Dyers, Manufacturers, Students, and All Interested in the Art of Dyeing* (London, 1893); Fraps, *Principles of Dyeing* (New York, 1903); Dyer and Color-Maker's Companion (Philadelphia, 1898); Recent Progress in the Industries of Dyeing and Calico-Printing, being a supplement to Sansone, *The Printing of Cotton Fabrics* (Manchester, 1895); id., *Dyeing* (ib., 1897); Sadler, *Industrial Organic Chemistry* (Philadelphia, 1900); Cain and Thorpe, *The Synthetic Dye Stuffs* (London, 1905); Pellew, *Dyes and Dyeing* (New York, 1913); Matthews, *Laboratory Manual of Dyeing and Textile Chemistry* (ib., 1913); and Yearbooks issued by the various color houses. See TEXTILE PRINTING; COAL-TAR COLORS; MINERAL COLORS; MORDANTS; and special articles on dyestuffs.

**DYER, ALEXANDER BRYDIE** (1817-74). An American soldier. He was born in Richmond, Va., graduated at West Point in 1837, and was assigned to the Third United States Artillery. He served in the Florida War in 1837-38 and as lieutenant of ordnance in the war with Mexico in 1846-48, being brevetted captain for gallant conduct. At the beginning of the Civil War he did much to increase the efficiency of the Ordnance Department, and in 1864 was appointed chief of ordnance at Washington, with the rank of brigadier general—a position which he held until his death. From 1861 to 1864 he had charge of the Springfield (Mass.) armory and in 1865 was brevetted major general in the regular army.

**DYER, ELIPHALET** (1721-1807). An American legislator and soldier. He was born at Windham, Conn., graduated at Yale in 1740; and was admitted to the bar in 1746. He held several Colonial offices, originated the plan of establishing a Connecticut colony in the Susquehanna valley, and was sent to England in 1763 as the agent of the Susquehanna Land Company. He was lieutenant colonel of a Connecticut regiment in the French and Indian War, was the first commissioner sent by Connecticut to the Stamp Act Congress in 1765, and was a member of every Continental Congress excepting those of 1776 and 1779. From 1776 to 1793 he was a judge of the Superior Court and for the last four years was Chief Justice.

**DYER, GEORGE** (1755-1841). A prolific writer, inveterate student, and amiable eccentric, who will live at least in Lamb's letters and in his essay, "Amicus Redivivus," where Dyer's absent-minded and well-nigh fatal plunge into the New River is described with gentle humor. Born a poor boy, he found friends who helped him to an education at Christ's Hospital and Cambridge (Emmanuel College). He became an insatiable bibliographer, and he wrote notably: *Poems* (London, 1792); *Poems and*

*Critical Essays* (ib., 1802); *History of the University and Colleges of Cambridge* (2 vols., ib., 1814); *Privileges of the University of Cambridge* (ib., 1824). His editorial labors over Valpy's 141-volume edition of the classics were so excessive as to induce total blindness.

**DYER, HENRY** (1848- ). A Scottish engineer and educator. He studied at Anderson's College (later called Glasgow and West of Scotland Technical College) and at Glasgow University. In 1873 he was chosen principal and professor of civil and mechanical engineering in the newly founded Japanese Imperial College of Engineering. He lived in Japan for 10 years, teaching and directing large engineering projects. On his return to Glasgow he took an active part in movements for social and educational reform, especially on industrial education. He is the author of *The Evolution of Industry* (1895); *Dai Nippon: The Britain of the East* (1904); *Japan in World Politics* (1909).

**DYER, ISADORE** (1865- ). An American physician, born at Galveston, Tex. He graduated from Sheffield Scientific School (Yale) in 1887, studied at the University of Virginia, and took his M.D. in 1889 at Tulane University, where, after three years as interne and lecturer in New York, he served in various capacities, becoming professor of diseases of the skin and dean of the medical department in 1908. He also actively identified himself with the work of New Orleans hospitals and with the care of lepers, in 1894 founding the Louisiana Leper Home. In 1908 he was appointed a lieutenant in the United States Army Medical Reserve Corps. He was vice president of the American Medical Association (1903) and of the New York Medico-Legal Society (1908-10), and president of the Louisiana State Medical Society (1902-03) and of the Southern Medical Association (1910-11). In 1896 he became editor of the *New Orleans Medical and Surgical Journal*, and he is also author of articles in various medical text and reference books.

**DYER, JOHN** (c.1700-58). An English poet, born at Aberglasney, Carmarthenshire, Wales. He took up painting and in pursuit of his art wandered through South Wales and the English counties adjacent. After studying art in Italy he returned to England, took orders, and held several livings. His writings include chiefly: *Grongar Hill* (1727), still found in many editions; *The Ruins of Rome* (1740), of which Dryden well remarks that "the title raises greater expectation than the performance gratifies"; *The Fleece* (1757), referred to by Wordsworth in his sonnet "To the Poet, John Dyer."

**DYER, LOUIS** (1851-1908). An American educator and author, born in Chicago, Ill. He graduated at Harvard in 1874, and at Balliol College, Oxford, in 1878, and was assistant professor of Greek at Harvard in 1881-87. In 1889 he was a Lowell Institute lecturer, in 1893-96 a lecturer at Balliol College, Oxford, in 1895-96 acting professor of Greek in Cornell University, and in 1896 a lecturer before the Royal Institution. In 1900 he gave at the University of California a series of lectures which was repeated at many colleges and universities. His publications include: a translation of Cossa's *Introduction to the Study of Political Economy* (1893); *The Greek Question and Answer* (1884); *Studies of the Gods in Greece*

(1891); *Oxford as it is* (1902); *Machiavelli and the Modern State* (1904).

**DYER, or DYAR, MARY** (?-1660). One of the victims of the persecution of the Quakers in early Massachusetts. She and her husband, William Dyer, a milliner, emigrated from London to Boston, Mass., in 1635, but in 1638, owing to their support of Anne Hutchinson in the Antinomian controversy, were forced to remove to Rhode Island. She spent the years 1652-57 in England, where she was converted to Quakerism, and in 1658 was expelled from the Colony of New Haven for preaching Quaker doctrines. In September, 1659, she was arrested and imprisoned in Boston, whither she had gone to visit three Quakers who had already been thrown into prison, and soon afterward she was banished with the others on pain of death should she remain in the Colony or return to it. In October she returned to Boston and was promptly sentenced to death, but was reprieved after being forced to witness the hanging of two other Quakers, Robinson and Stephenson. In May, 1660, she again visited Boston, was again condemned to death by Governor Endecott for "rebellious sedition and obtruding herself after banishment upon pain of death," and this time was publicly executed by hanging on Boston Common, June 1, 1660. Consult Rogers, *Mary Dyer, the Quaker Martyr* (Providence, 1896), and Jones, *The Quakers in the American Colonies* (New York, 1911).

**DYER, NEHEMIAH MAYO** (1839-1910). An American naval officer, born at Provincetown, Mass. He volunteered in the army in 1861; but was transferred to the navy, in 1864 was promoted to be acting master and placed in command of the *Randolph*, in 1868 became lieutenant commander and in 1883 commander. Promoted to be captain in 1897, he commanded the protected cruiser *Baltimore* in the battle of Manila Bay, May 1, 1898. In 1901 he received the rank of rear admiral and was retired. He was chairman of the commissioners of the Massachusetts Nautical Training School in 1903-04.

**DYER, THOMAS HENRY** (1804-88). An English historian, born in London. In 1841 he published his *Tentamina Æschylea*, the result of his studies in the emendation and restoration of passages. Most important among his works are: *Life of Calvin* (1850); *History of Modern Europe* (4 vols., 1861-64; 2d ed., revised and enlarged, 5 vols., 1877); *The History of the Kings of Rome* (1868). His *History of the City of Rome* (1865) was the first connected narrative on that subject, and his *Pompeii: Its History, Buildings, and Antiquities* (1867) contained a careful description of the remains so far as known up to that time. His works were scholarly, drawn from authentic sources, and clear in their structure.

**DYER, SIR WILLIAM TURNER THISTLETON** (1843- ). An English botanist. He was born at Westminster and was educated at King's College, London, at Oxford, and at Halle, Germany. He became professor of natural history at the Royal Agricultural College, Cirencester, in 1868, and professor of botany at the Royal College of Science for Ireland in 1870. From 1885 to 1905 he was director of the Royal Gardens at Kew. He was a fellow of the University of London from 1887 to 1890, Royal Commissioner to the Paris International Exhibition (1900) and to the St. Louis Exposition (1904), botanical adviser to the Secretary of State for

the Colonies (1902-06), and became a member of the court of the University of Bristol in 1909. His principal works are an English edition of Sachs's *Text-Book of Botany* (1875), editions of the *Flora Capensis* and of the *Flora of Tropical Africa*, and *Index Kewensis* (1905). With Trimen he published *The Flora of Middlesex* (1869).

**DYER'S BROOM** (*dyer* + *broom*, plant), DYER'S GREEN WEED, or WOADWAXEN (*Genista tinctoria*). A leguminous shrub of European origin, bearing yellow flowers and simple leaves, and said to be the bush Genêt, from which the Plantaginaceae family took its name. In Europe its tops were formerly used for a yellow dye. It was extensively cultivated in New England and has escaped and become established in portions of New York and Massachusetts.

**DYERSBURG.** A city and the county seat of Dyer Co., Tenn., 77 miles north-northeast of Memphis, on the Illinois Central, the Birmingham and Northwestern, and the Chicago, Memphis, and Gulf railroads, and on the Forked Deer River, at the head of navigation (Map: Tennessee, A 2). It is in a fertile agricultural region, producing cotton, wheat, and corn, and has cotton gins, a compress, a cottonseed-oil mill, saw, planing, and flour mills, wagon factories, a grain elevator, pressed brick, tile, and stave and heading factories, a tobacco factory, a foundry, a machine shop, a wooden-bowl factory, etc. The water works, sewage system, and electric-light plant are owned by the municipality. Pop., 1890, 2009; 1900, 3647; 1910, 4149.

**DYER'S ROCKET**, or DYER'S WEED. See WELD.

**DYES, DYEING.** See COAL-TAR COLORS.

**DYESTUFFS.** See ANIMAL COLORS; COAL-TAR COLORS; MINERAL COLORS; VEGETABLE COLORS; DYEING; TEXTILE PRINTING.

**DYING DECLARATION.** See DECLARATION, DYING.

**DYING GAUL.** A famous statue, probably a Greek original, in the Capitoline Museum, Rome. It was formerly erroneously called "The Dying Gladiator" and was beautifully described as such by Byron in *Childe Harold's Pilgrimage*. In reality, it represents a dying Galatian and belongs to one of two groups dedicated respectively at Pergamum and Athens by Attalus I, King of Pergamum, to commemorate his victory over the Celtic Galatian tribes who invaded Asia Minor in the second century B.C. In this statue a tragic idea is expressed with powerful realism and remarkable technique.

**DYKE.** See DIKE.

**DYKES, JAMES OSWALD** (1835-1912). A Scottish Presbyterian clergyman and educator, born at Port Glasgow. He studied at the universities of Edinburgh, Heidelberg, and Erlangen, was ordained to the Presbyterian ministry in 1859, and in 1861 became copastor with Dr. Candlish of Free St. George's Church, Edinburgh. In 1869 he was appointed pastor of the Regent Square Church, London, and in 1888 principal of the Theological College of the Presbyterian church of England. His publications include: *From Jerusalem to Antioch* (1875); *The Law of the Ten Words* (1884); *The Gospel According to St. Paul* (1888); *Plain Words on Great Themes* (1892); *The Christian Minister and his Duties* (1908); *The Divine Worker in Creation and Providence* (1909).

**DYLSK.** See DULSE.

**DYMOND, JONATHAN** (1796-1828). An

English writer. He was a member of the Society of Friends and was prominent as an expositor of the principles of his sect. In 1823 he published anonymously an *Inquiry into the Accordance of War with the Principles of Christianity*, which attracted wide attention. His chief work is his *Essays on the Principles of Morality* (1831), which is devoted to the application of moral principles and attacks war and dueling.

**DYMOV, OSIP** (the pseudonym of OSIP ISIDOROVITCH PERELMAN) (1878- ). A popular Russian writer. He was born at Bialostock, but removed to the United States and settled in New York. His short stories and plays, some of them dealing with Jewish life, are of considerable merit. He excels, however, in his briefer sketches and parodies, which are full of humor. A collection of his humorous stories appeared in 1910 under the title *Merry Melancholy*. His plays include *Cain* (1906), *Hear Israel* (1907), *Every Day* (1908), and *The Eternal Wanderer* (1913).

**DYNAMETER** (contracted from *dynamometer*, from Gk. *dýnaxis*, *dynamis*, power + *μέτρον*, *metron*, measure). An instrument for measuring the magnifying power of a telescope. The power of a telescope is found by dividing the focal length of the object glass by the focal length of the eyepiece; which quotient equals that obtained by dividing the diameter of the object glass by the diameter of its range formed at the focus, and seen through the eyepiece. The object of the dynameter is to measure the diameter of this image. Practically the magnifying power may be measured as follows: The telescope is directed to the daylight sky. A small, round, bright spot is then seen on looking at the end of the eyepiece. This spot is an image of the object glass. The diameter of the spot is measured with a dynameter, or any micrometric instrument capable of measuring small objects accurately. The object glass being then also measured, a simple division of the object-glass diameter in inches by the diameter of the spot, also in inches, gives the magnifying power.

**DYNAMICS** (Gk. *δυναμικός*, *dynamikos*, powerful, from *dýnaxis*, *dynamis*, power, from *δύνασθαι*, *dynasthai*, to be able). That branch of mechanics (q.v.) which treats of the motion of matter. It embraces the discussion of the conditions under which the motion of matter is changed and the mathematical properties of this motion. Dynamics is sometimes divided into the two great subjects *statics* and *kinetics*, statics being the discussion of conditions under which there is no change in the motion; kinetics, those under which there is change. Dynamics of a "particle" treats the motion of a geometrical point endowed with mass. "Rigid" dynamics treats the motion of large, rigid bodies; i.e., those made up of particles so connected that they have no relative motion.

**DYNAMIC UNITS.** See MECHANICAL UNITS.

**DYNAMITE** (from Gk. *dýnaxis*, *dynamis*, power). Any explosive substance consisting of nitroglycerin and an absorbent, which is fired by detonation, is styled dynamite. The original one, consisting of nitroglycerin and an absorbent such as infusorial earth (*Kieselguhr*) or diatomaceous silica, tripoli, rotten stone, etc., was invented in 1866 by Alfred Nobel. The quantity of nitroglycerin in their mixtures varies from 75 per cent down to 30 per cent of nitro-

glycerin, but 40 per cent of nitroglycerin is given as the average amount. Nobel also made use of gunpowder as an absorbent. In the United States the absorbent often is an aid to combustion, and consists of a mixture of wood pulp and sodium nitrate, with small quantities of magnesium or sodium carbonate to neutralize any acid which may be present in the mixture. The product when thus formed is known as a straight dynamite, but nitrates, charcoal, and wood fibre may be used for the absorbing material. Perhaps the most powerful form of dynamite is the explosive or blasting gelatin also invented by Nobel, in 1875, where pyroxilin or soluble cellulose nitrate is dissolved in water and a jelly-like mass produced. When this material is mixed with wood pulp and potassium nitrate, the resulting product is known as gelatin dynamite. We have therefore dynamites with an inert base and dynamites with an explosive base or dope.

When ammonium nitrate is used in the composition, we have ammonia dynamites. When di- and tri-nitroglycerin or nitrochlorhydrin or nitrosubstitution compounds are put in the dope, we have so-called L. F. (low-freezing) dynamite. For commercial use the dynamite is usually made up in sticks or cartridges 8 inches in length and 1 to 3 inches in diameter, which are packed in sawdust or cartons in cases containing 50 pounds each. See EXPLOSIVES; NITROGLYCERIN.

The United States census gives statistics for the production of dynamite in the United States as follows:

YEAR	PRODUCTS	
	Pounds	Value
1880.....	30,626,738	\$622,671
1890.....	30,626,738	4,253,032
1900.....	55,846,456	8,247,223
1904.....	130,920,829	12,900,193
1909.....	195,155,851	18,699,764

**DYNAMITE CRUISER.** See ORDNANCE, *Classes of Cannon.*

**DYNAMITE FARMING.** A term which has come into popular use, designating more particularly that use of dynamite on the farm which enters into soil operations for the direct improvement of cultural conditions, as distinguished from the much longer established uses of the explosive in clearing land of trees, stumps and bowlders, splitting stumps and logs, excavating for foundations, digging wells and post holes, and in other similar kinds of work. This particular use has for its purpose the loosening of the soil as a means for the removal of difficulties in drainage, aëration, and moisture absorption resulting as a rule from hardpan or otherwise similarly compacted conditions near or within a few feet of the surface. Many soils have the tendency to become compacted just below the depth of plowing, and the dense and hardened layer formed there is as impervious to water as are the typical hardpans. To remove these unfavorable conditions in a quick and effective manner the land is subsoiled by means of dynamite if the cost of the operation does not outweigh prospective returns. The manner of procedure is largely determined by the character of the sub-

soil to be broken, its thickness, and its depth below the surface. Holes  $1\frac{1}{2}$  inches in diameter are made with a soil auger or an iron bar at such intervals that the effect in the soil produced by one explosion meets that of the ones next to it. For this reason the holes are generally placed the same distance apart in both directions. When the holes are spaced 8 to 10 feet apart, they are made from  $2\frac{1}{2}$  to 3 feet deep and half a stick or a whole stick of dynamite is used in each. Sometimes the holes are spaced only from 4 to 8 feet apart and made only about 2 feet deep. With this spacing and depth, a charge of  $\frac{1}{4}$  of a stick of the explosive will generally have the desired effect. In thick hardpan the distance between holes ranges from 15 to 30 feet and the charge, consisting of 1 to  $1\frac{1}{2}$  sticks, is placed about a foot above the bottom of the hardpan. The downward action of the dynamite explosion is quite marked, a charge placed  $2\frac{1}{2}$  feet deep shattering even in heavy soils to a depth of about 4 feet. The best results with the holes 15 feet or more apart are secured by exploding a number of charges at the same time by means of electricity, but at the closer distances the explosion of each charge by itself with fuse and blasting caps serves the purpose. In preparing soil for tree planting the holes are made where the trees are to stand and the charges are most readily exploded individually. Before setting the trees, any cavity that may have formed is filled to prevent the possible gathering of water, the more rapid drying of the soil, or the sinking of the tree with the probable settling of the soil. Dynamite is also used in opening the underlying soil of swampy places to allow the water to pass into the lower layers. It is also used in the construction of drainage and other ditches. In all this work a slow-acting or low-strength dynamite, designated as 25, 30, or 40 per cent, carries the shattering effect to greater distances in the soil and gives better results than a quick-acting or high-strength dynamite.

**DYNAMITE GUN.** See AIR GUN.

#### DYNAMO-ELECTRIC MACHINERY.

Machinery in which mechanical energy is converted into electrical energy, or vice versa, by means of magnetic induction. According to this definition, every dynamo-electric machine is capable of serving either as a generator or as a motor, according to whether it is supplied with mechanical or electrical energy and whether it is therefore giving out electrical or mechanical energy respectively. In an electric generator mechanical energy is converted into electrical energy by means of continuous relative motion between electrical conductors and a magnetic field, or fields, such motion causing the conductors to cut the lines of force of the fields. In an electric motor electrical energy is transformed into mechanical energy by means of continuously supplying a system of electrical conductors with an electric current, which causes a magnetic force to act between the conductors carrying it and the magnetic field, or fields, thereby producing continuous relative motion between the conductors and the magnetic fields.

The preceding definitions are general and necessarily technical. To comprehend them fully a knowledge of the fundamental principles involved in the operation of dynamo-electric machines is necessary. They may, however, be in a measure elucidated by a descriptive defini-

tion as follows: All generators consist essentially of one or more electromagnets between the poles of which an armature, consisting of a soft iron core wound with coils of insulated copper wire, is made to revolve very rapidly by means of a steam engine, a water wheel, or other prime mover. The current produced in the generator may be transmitted by wires to a considerable distance and there be converted into mechanical energy again by being made to pass through another machine, similar and often identical in construction, and there cause the armature to revolve, and this revolution may be employed to do any kind of mechanical work. This second machine, working in reverse order from the first, is an electric motor. This description makes it clear, as do the preceding definitions, that to understand thoroughly the dynamo-electric machine requires a knowledge of three great branches of science—magnetism, electricity, and mechanics. The necessity for this special knowledge makes the subject of dynamo-electric machines a difficult one to discuss in universally familiar terms. At best, therefore, only an indication of the structural details and operating principles involved is possible under such conditions.

**Fundamental Principles.** To understand the fundamental principles involved in the operation of dynamo-electric machines, consider first two magnetic poles, *N* and *S*, of opposite polarity placed near to each other, as in Fig. 1. Between the poles *N* and *S* is a field of magnetic force

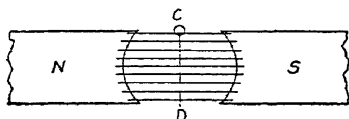


FIG. 1.

composed of so-called lines of magnetic force, which may be pictorially indicated by parallel lines, as is done in the illustration. If a conductor, e.g., a round copper bar *C*, is placed in the magnetic field, with its axis horizontal and perpendicular to the lines of force, and is raised and lowered along the path *CD* so as to cut the lines of force, an electromotive force is set up or induced in the conductor. The magnitude of the electromotive force produced in the conductor depends upon the rate at which the lines of force are cut. Owing to this electromotive force, one end of the conductor is raised to a higher electrical potential than the other, in consequence of which there is a tendency for electricity to flow along the conductor, and if its two ends are electrically joined by a conductor exterior to the magnetic field, a current will flow through this circuit. If the gap between the poles *N* and *S* were infinite in extent in the direction *CD*, and if the conductor *C* in its motion along this infinite path were supplied with some sort of sliding contacts, so that a closed circuit would be maintained, the device would possess all the essential features of a generator or of a motor. An equivalent condition is secured (1) if the magnet is bent so that the *N* and *S* poles face each other across a narrow gap; (2) if the conductor *C* is arranged so as to rotate in the gap between the *N* and *S* poles as a radius pivoted on the common axis of *N* and *S*; and (3) if sliding contacts are provided at the centre of rotation and at the extremity of the conductor outside of the polar forces; the device then be-

comes a homopolar generator or motor. The conductor *C* may be replaced by a rotating metal disk with similar contact devices.

The form of machine just described is noteworthy chiefly because of its simplicity and the fact that it was the first form to be invented. All commercial machines now in use operate in such a manner that the conductor moves alternately forward and backward through the field of force. To illustrate, if the conductor *C*

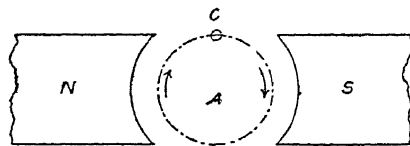


FIG. 2.

(Fig. 2) be attached to the circumference of a cylinder or other round body, which rotates about an axis *A* perpendicular to the paper, it will cut the lines of force by alternate downward and upward motions. An electromotive force in one direction will be generated in the conductor *C* as it is going up, and in the opposite direction as it is coming down. If the ends of *C* are brought to the shaft *A* and formed into rings around it, brushes bearing on these rings, if connected to an external circuit, will receive an alternating current, i.e., one which flows first in one direction, then in the opposite direction. Machines of this description are called *alternators*; the rotating part is called the *armature*; the pole pieces, *N* and *S*, with the remaining magnetic circuit, are called the *field*; and the rings around the shaft are called *collector rings*. If the current collected is to flow always in the same direction in the circuit which is external to the machine, some device must be provided to change automatically the connection between the armature circuit and the external circuit. Such a device is called a *commutator*. Its operation may be explained as follows: If in Fig. 2 the ends of the conductor *C* are brought down to the shaft, and then parallel to it so as to make the complete loop shown by Fig. 3, it will be obvious that the electromotive forces generated in the two sides of the loop will be opposite in absolute direction, as indicated by the arrows, but in the same direction as regards the conductor itself.

If now the two ends *m* and *n* of the loop are attached to two half rings upon which brushes *a* and *b*, composed of thin strips of metal or other conducting material, rest, and these brushes are placed at such points that they pass from one half ring to the other at the same moment that the conductor *C* ceases cutting lines of force in one direction and begins to cut them in the other direction, the current in the external circuit *c* will always be in one direction. Machines of this description are called *direct-current ma-*

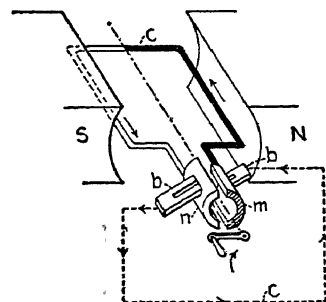


FIG. 3.

chines. When the machine is operated as an alternator as first described, the direction and intensity of the current may be represented by the ordinates or vertical distances from the axis  $OX$  of the curved line  $ABCD$  in Fig. 4., of

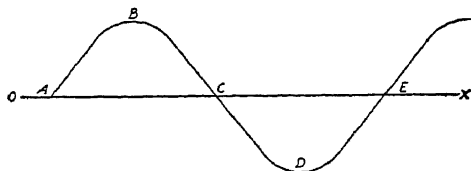


FIG. 4.

which the abscissæ or distances along the axis represent time. To illustrate, the distance  $A E$  represents the time of one complete revolution of the conductor. For half this time the current

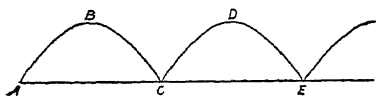


FIG. 5.

is in one direction represented by the curve above the axis and has an intensity rising from nothing at  $A$  to a maximum at  $B$  and then falling to nothing at  $C$ . For the other half of this time the direction of the current is represented by the curve below the axis and has an intensity increasing from nothing at  $C$  to a maximum at  $D$  and then decreasing to nothing again at  $E$ . When the machine is operated as a direct-current machine, the current produced may be represented by the curve  $ABCDE$  in Fig. 5, of which the ordinates and abscissæ have the same significance as in the curve previously explained. It will be noted that the curve being always above the axis shows the current to flow always in one direction, but to fluctuate in intensity. This excessive fluctuation is due to the fact that there is but one rotating coil, as shown by Fig. 3. Were another coil at right angles to the first to be added to the armature, the maximum electromotive forces in it would occur at the moments when there were no electromotive forces acting in the first coil. Likewise, if many coils are employed, the maximum electromotive forces generated in the several coils will occur at different instants, and if these coils are so connected that their electromotive forces are added to one another, the fluctuations will neutralize each other and the current obtained will be more uniform.

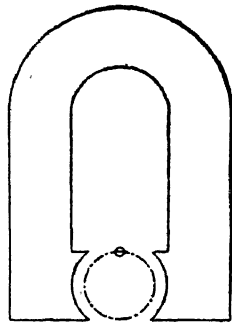


FIG. 6.

Thus far in this discussion the existence of a magnetic field has been assumed without inquiring in what manner it was provided. The manners in which such fields may be provided will now be described. In the earliest machines, and in many used for ignition purposes and the ringing of telephone signals, the field is provided by a permanent magnet which may be of the form shown by Fig. 6. In all machines of any considerable

size, however, the permanent magnet is replaced by an electromagnet. The method of producing such a magnet is indicated diagrammatically by

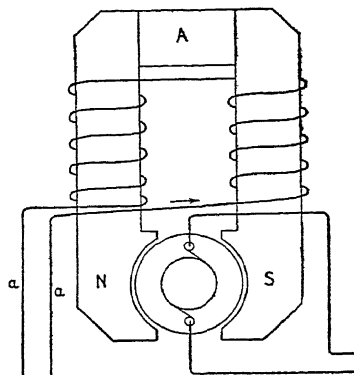


FIG. 7.

Fig. 7, in which the cast-iron or steel yoke  $A$  is wound with a coil of wire,  $a a$ . If a current flows through the winding in the direction indicated by

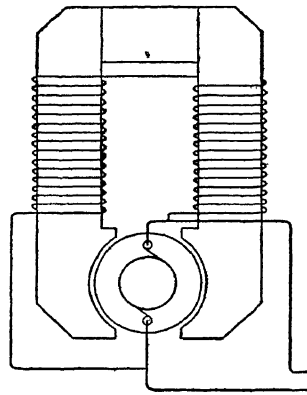


FIG. 8.

the arrow, magnetic poles will be produced at  $N$  and  $S$ , and a magnetic field will exist between them. The parts of the magnet may differ much in form and arrangement, but a magnetic circuit  $ANS$  interlinked or wound with an electric circuit  $a a$ , is an essential feature. A direct current is required for exciting the field. This may be ob-

tained from some external source, or, in the case of a direct-current generator, from the machine itself. There are three ways in which this self-excitation may be accomplished. If

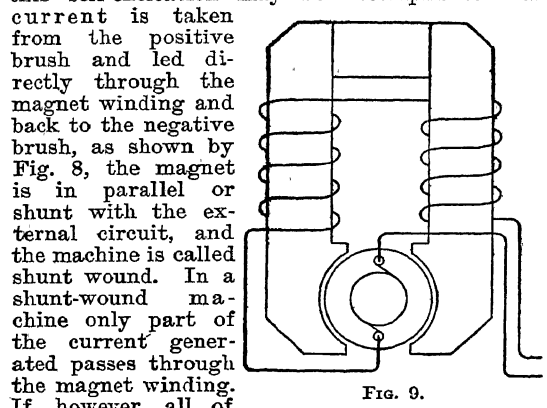


FIG. 9.

current is taken from the positive brush and led directly through the magnet winding and back to the negative brush, as shown by Fig. 8, the magnet is in parallel or shunt with the external circuit, and the machine is called shunt wound. In a shunt-wound machine only part of the current generated passes through the magnet winding. If, however, all of the current coming from the armature passes through the field magnet and then goes to the external circuit, as shown by Fig. 9, the machine is called series wound. If both shunt and series windings are employed, the machine is defined



as compound wound. Compound windings are of two classes, defined as long shunt and short shunt. In the former the current used in the

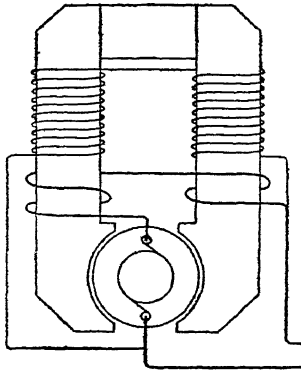


FIG. 10.

an auxiliary direct-current dynamo, called the exciter. The relative arrangement of the field-magnet winding and the exterior circuit in separately excited generators is shown by Fig. 7.

The machines shown in these various diagrams, and in fact all the machines so far mentioned, have had but two magnetic poles. It is evident, however, that there may be as many pairs of poles as is desired, so long as the armature connections are arranged to correspond. Machines having only one pair of poles are called *bipolar machines*; machines having two or more pairs of poles, are called *multipolar*. Most machines now built, except those of very small size and those driven at very high speed, are multipolar machines, a typical form being shown in Fig. 12. There are usually as many brushes bearing on the commutator as there are field poles, but this is not absolutely

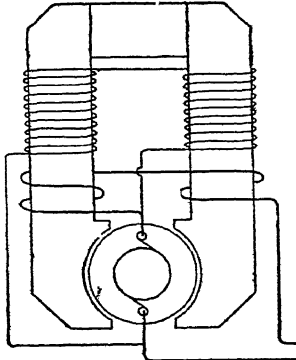


FIG. 11.

necessary, since the armature conductors may be so connected as to require only two brushes. The latter practice is followed in street-railway motors.

**Materials.** The materials entering into the construction of the various parts of dynamo-electric machines are as follows: The magnetic circuit in the field is

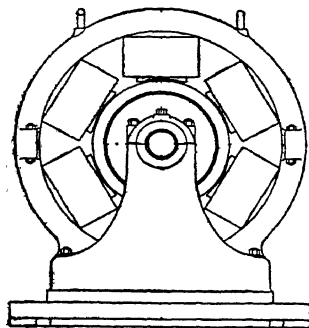


FIG. 12.

usually composed of cast iron or steel. The pole pieces may be of the same material as the field, or they may be composed of soft iron laminæ, or sheets, placed edge on to the shaft of the machine. In small and medium-sized machines

the base and pillow blocks of the armature shaft are nearly always cast in one piece with the field. The body of the armature upon which the conductors are wound is always built up of iron laminæ placed edge on to the shaft. The object of using laminæ here and in the pole pieces is to prevent electric currents from flowing in the iron of the armature itself. Such currents would absorb power and needlessly heat the armature. The conductors themselves in both the field and the armature windings are copper wires or bars carefully insulated from the iron parts and from one another by cotton thread, or cloth, paper, cardboard, mica, etc. The commutator of direct-current machines is built up of copper segments separated by strips of mica. The brushes that bear upon the commutator in most modern machines take the form of blocks of carbon. In alternating-current machines there is no commutator, it being replaced by copper, brass, or iron rings.

**Historical Development.** In the preceding paragraphs the several parts of dynamo-electric machines and the functions which they exercise have been described, and the attempt has been made to elucidate briefly and nontechnically the principles at the basis of their operation. An account will now be given of their development, and afterward the several types of machine in commercial use will be described.

The principle of electromagnetic induction, upon which the operation of the dynamo-electric machine is based, was discovered by Michael Faraday in 1831. In his first experiments Faraday produced a current in a coil of wire by starting or stopping a current in a neighboring coil. He then generated currents in a coil by moving it between the poles of a magnet. His first electric motor was a homopolar machine. A disk of copper was so mounted that it could rotate between the poles of a permanent magnet transversely to the direction of the lines of force. When a current was applied at the axis of the disk and led off at the periphery, the disk rotated continuously. Faraday constructed a number of machines upon this principle, one of which consisted of a copper hollow cylinder closed at one end and hung over and inclosing a bar magnet. The cylinder rested upon a vertical pivot at the closed end and the open end dipped into a cup of mercury. When a current was caused to traverse the cylinder lengthwise, the cylinder rotated continuously about the magnet. Faraday's next machine employed a rotating rectangle of wire like that shown in Fig. 3 above, except that no magnet was used such as is shown in the drawing. When the axis of the rectangle was placed east and west and the rectangle was rotated, alternating currents could be drawn from slip rings attached to the coil, or, by employing a commutator, direct current could be obtained. It will be noted that the only magnetic field employed was that of the earth. The first machine to give a continuous current was constructed by Sir Charles Wheatstone, an Englishman, in 1841. The armature of his machine was wound with six coils, each of which was connected to the brushes only at the instant when it was at its greatest activity. The use of electromagnets instead of permanent magnets for the field was patented by Wheatstone and Cooke in 1845. A self-excited machine was constructed by Jacob Brett in 1848. The drum-wound armature in which the conductors are wound on the outside

of an iron cylinder or drum was introduced by Werner Siemens at about the middle of the last century. At about the same time or a little later a type of armature constructed in an entirely different fashion was introduced by Gramme. Instead of winding the wires on the outside of a cylinder placed between the magnet poles, he wound them upon an iron ring. The Gramme-ring type of armature was at one time extensively used, but it has almost entirely disappeared from use at the present time. Designs of multipolar machines began to appear about 1880, and it was at about that time also that engineers began to study the principles entering into the design of dynamo-electric machines for commercial purposes. Since 1880 the greatest development has been in the direction of improving details of design and of mechanical construction.

**Commercial Types.** Turning now to the different types of dynamo-electric machines in use, it may be said in general that as they are now built in Europe and in America such machines differ in very few and in nonessential particulars. Only what may be called the standard types of dynamo-electric machines now in commercial use are described below.

Constant-current, direct-current machines were formerly much used for series arc lighting (see ELECTRIC LIGHTING). The essential feature of such a system is to maintain a constant current through the lamps, independent of the number of lamps in circuit, which of course necessitates a variation in pressure or voltage at the terminals of the dynamo. The required regulation of pressure in the old types of arc-lighting machines was accomplished by an automatic shifting of the brushes, causing some of the coils to act in opposition to other coils, thus counteracting each other and reducing the voltage, or vice versa. In modern practice, the direct-current series arc is extensively used in conjunction with constant-current mercury-arc rectifiers which convert alternating current from standard constant potential transformers into a direct current of constant value. Alternating-current series lamps are supplied through constant-current transformers. See RECTIFIER; TRANSFORMER.

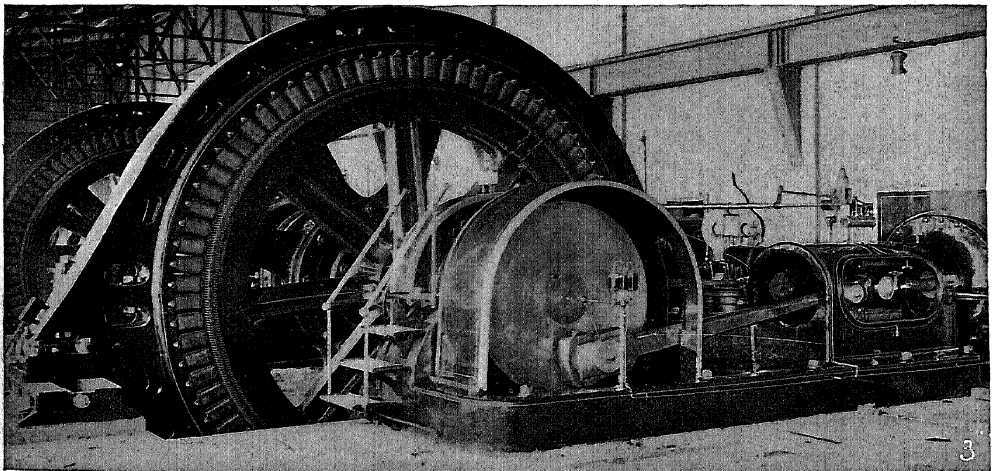
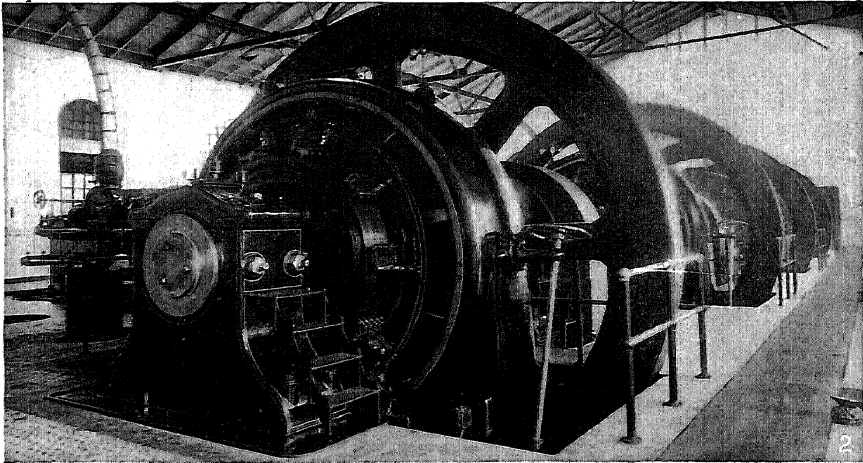
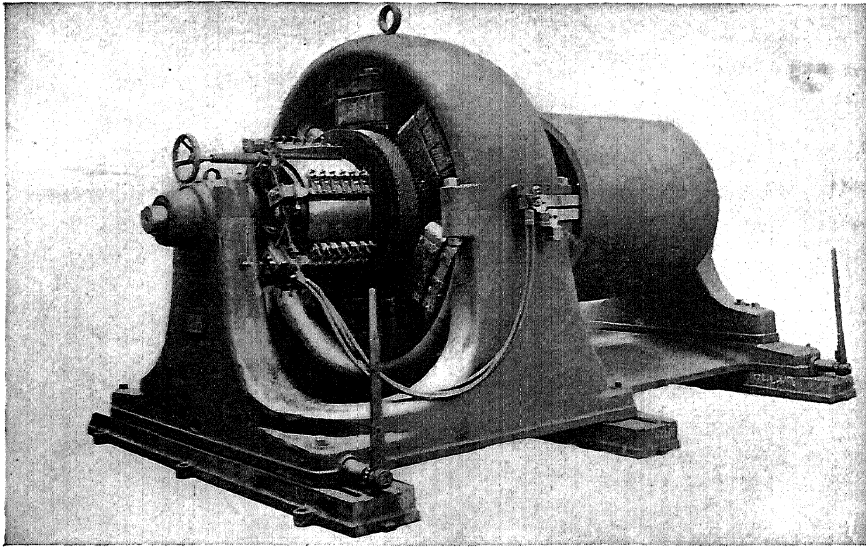
By far the greater number of direct-current generators are constant-potential machines and are, if they are not separately excited, either shunt wound or compound wound. Generators of this type are used for supplying current for electric street railways, incandescent lighting, electrolytic work, and other purposes for which a direct current of comparatively low voltage is desired to be supplied at a constant potential irrespective of the load. In separately excited or shunt-wound machines the regulation of the current to constant potential is usually performed by inserting a rheostat or variable resistance in circuit with the field winding. By increasing or decreasing this resistance, usually by hand, the field current and therefore the electromotive force are decreased or increased. In compound-wound machines the regulation is accomplished as follows: When there is no load upon the generator, the excitation of the magnets is produced entirely by the shunt winding, but as the load is increased the current flowing through the series coils aids that in the shunt coils, thus producing stronger fields and increasing the electromotive force at the generator terminals. The exact regulation of generators to

the proper terminal voltage is now largely accomplished by an automatic device which connects across the terminals of the control rheostat a low-resistance shunt at intervals whose frequency varies with the degree of regulation required. Small direct-current generators, whether operated at constant current or constant potential, are usually driven by belting from the engine or other prime motor, but large machines, in modern practice, are connected directly to the shaft of the prime motor. Typical direct-current constant-potential generators are shown on the pages.

The machine used as a motor will now be considered. If a dynamo-electric machine which has been connected for working as a generator be supplied with a current from an exterior source instead, it will run as a motor, the direction of the rotation depending upon the manner of the field excitation. A series machine, since both the armature and field currents are then reversed, will run in the opposite direction from that in which it was driven as a generator with the same electric polarity. A shunt-wound machine will rotate in the same direction when run as a motor as it did when driven as a generator, for, while the armature current is reversed, the field current remains unchanged in direction. A compound-wound machine will rotate in the same direction or in the opposite direction as a motor that it did as a generator, according as the shunt winding or the series winding is the more powerful; and while the field excitation as a generator was the sum of the series and the shunt windings, the field excitation as a motor is their difference. Another peculiarity of the dynamo-electric machine when operated as a motor which requires to be noted is that in such a machine operating as a generator there is only one electromotive force acting, but in the same machine operating as a motor there are two opposed electromotive forces acting. The reason for this is that the armature of a motor revolving in a field has an electromotive force induced in it exactly as in a generator. The direction of this induced electromotive force is, however, such as to oppose the current flowing through the armature under the influence of the external supply of electromotive force. Therefore this pressure, which is induced in the armature of a motor, is called counter electromotive force.

The current in the armature is due and proportional to the difference between the applied electromotive force and the counter electromotive force. The counter electromotive force is proportional to the product of the speed of the conductor and the field strength. It is evident that when the armature of a motor is at rest there is no counter electromotive force acting, and that the highest speed it may reach is that at which the counter electromotive force equals the applied electromotive force. In starting up a motor an external resistance has therefore to be provided to take the place of the counter electromotive force in order to resist an excessive inrush of current to the motor and prevent possible destructive action from it before the inertia of the armature has been overcome and rotation begun. This exterior resistance is commonly provided by a starting box, or rheostat, which is a device by which the current is gradually applied. Destructive currents may also arise during operation from various causes, and, to prevent damage from these, automatic attachments

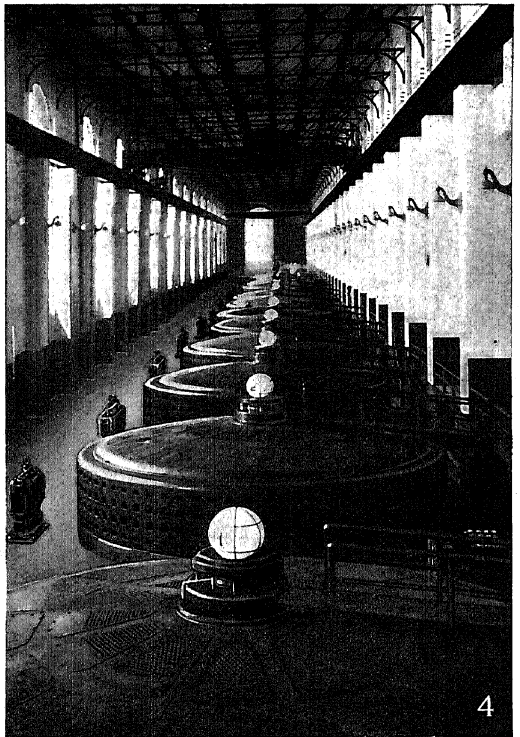
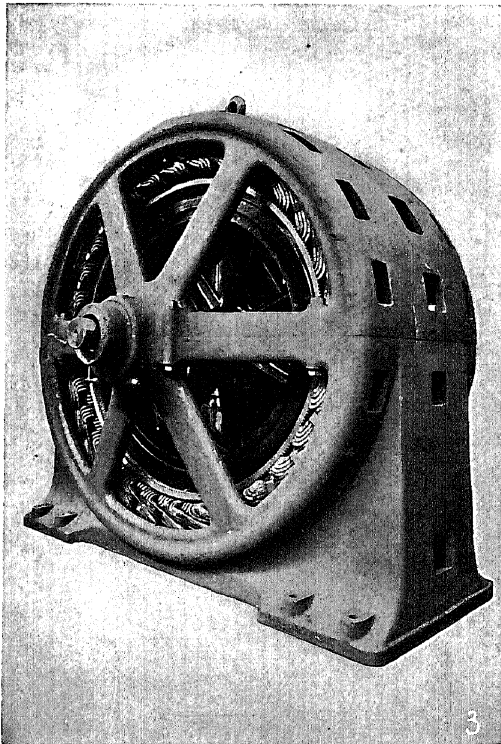
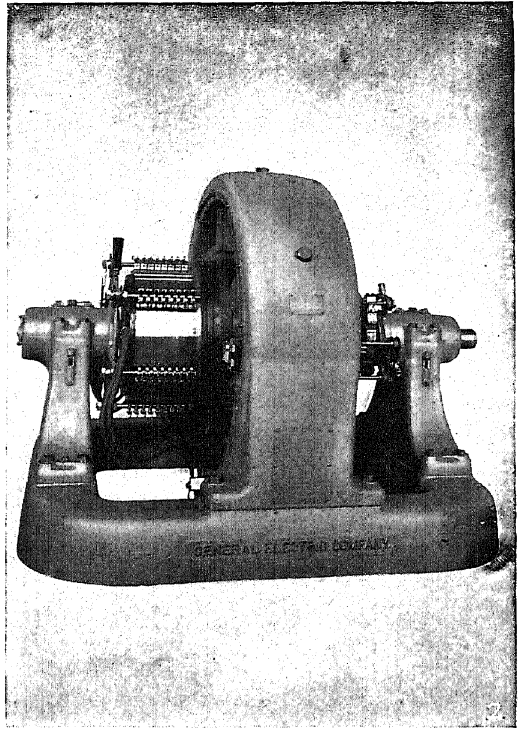
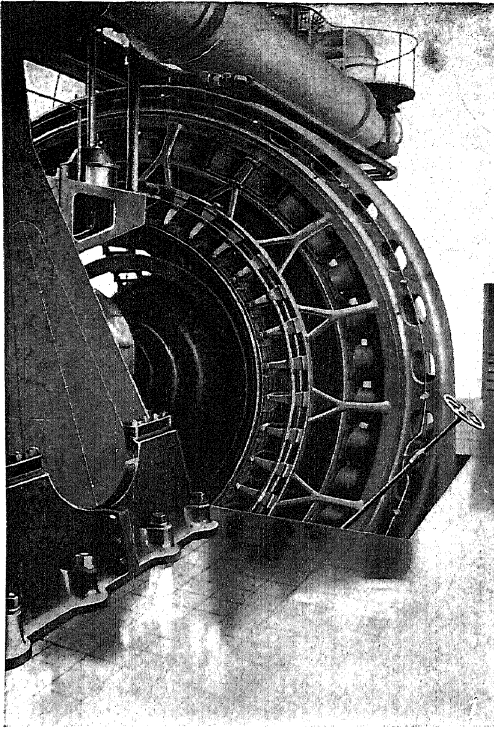
# DYNAMO-ELECTRIC MACHINERY



1. WESTINGHOUSE DIRECT CURRENT LIGHTING AND POWER GENERATOR BELTED TYPE

2. GROUP OF WESTINGHOUSE DIRECT CURRENT ENGINE-TYPE GENERATORS IN RAIL WAY POWER HOUSE.

# DYNAMO-ELECTRIC MACHINERY



1. GENERAL ELECTRIC COMPANY, 2700 KILO-WATT, 575 VOLT, RAILWAY GENERATOR.

3. WESTINGHOUSE 850 HORSE-POWER ALTERNATING CURRENT INDUCTION MOTOR.

are often provided, which open the circuit and stop the current. The turning effect or moment of an armature, technically known as its torque, is proportional to the product of the armature current and the strength of the magnetic field.

The effect of changes of load on the performance of a motor will be briefly considered. An increase in the mechanical load demands a torque greater than that being developed and tends to reduce the speed of the motor. The falling speed reduces the back electromotive force of the armature and so causes it to take an increased current sufficient to provide the required torque at steady speed. Conversely, if the load is reduced, an increase of speed occurs, and the current through the armature is reduced. If the field strength is only slightly affected by the changes in armature current, as in the shunt motor, the natural changes of speed with load are small, and the motor is adapted to service requiring approximately constant speed. In the series motor, however, the field strength varies greatly with the armature current, and an increased torque requirement involves a marked speed reduction. Conversely, the series motor increases greatly in speed with a fall of load and may rise to a dangerous speed if the load is entirely removed. The series motor finds its field where heavy torque at low speed and high speeds at light loads are desired, as in railway operation.

The regulation of the speed of a shunt motor rests upon the principle that at any load the speed must be such as to cause the armature to develop the proper counter electromotive force. If the field strength is reduced, the speed tends to rise. If the voltage applied to the armature is reduced while the field is kept constant, less counter electromotive force is required, and the speed falls. Speed-control systems for shunt motors are therefore of two general types, viz., those which adjust the field strength by increasing or reducing the resistance of the field circuit and those which vary the voltage applied to the armature. For very wide ranges of control these two systems are often combined. Very wide ranges of speed are apt to cause motors to spark badly at the commutator, and a special form of field structure is often employed to correct this tendency. Narrow poles with series windings are placed midway between the main shunt-wound poles and serve to produce in those armature coils whose connections are being reversed at any instant local electromotive forces which overcome the reluctance of the currents in these coils to reverse.

Probably the form of motor which is used in the greatest numbers is the *direct-current street-railway motor*. A series-wound motor operating on a constant-potential circuit is universally used for street-railway work. These machines have to be unusually sturdy to withstand the conditions of service which require them to endure the shocks and jolts due to rough track, as well as the dust, mud, slush, and rain of storms and dirty streets, and often the abuse of ignorant or careless motormen. Street-railway motors, one of which is illustrated by Fig. 13, are usually constructed with four poles, but use only two commutator brushes, placed in such a position as to be easily accessible. The field frame which carries the poles is made of such shape as to inclose all the working parts and thus protect them from dirt and moisture.

It is general practice to equip each trolley car

with at least two motors and to regulate the speed of the car in the following manner: First, the two motors and a resistance are connected in series. The resistance is then cut out step by step until the two motors are operating in series on 500 volts. This is called a running connection. To increase the speed further, the motors are placed in parallel with a resistance in series with both. This resistance is then cut out step by step until the motors are each operating on 500 volts. This again constitutes a running connection. A further change is sometimes effected by placing a small resistance in shunt with the fields when all the series resistance is out. This reduces the field flux and causes a higher armature speed to maintain the necessary counter electromotive force. A car governed in this way has four running connections. On heavy cars, such as are used in elevated-railway or interurban service, four motors are used on each car. In this case the motors are governed in two series-parallel combinations, as if there were two separate cars governed by one controller. In many of the recently installed interurban systems the trolley voltage is either 1200 or 2400. In such systems the unit of control is a pair of motors connected in series. The different connections are made by a motorman, who operates a handle on top of a controller. Each different combination is called a point, or notch. A pointer fixed to the controller handle indicates at what notch the car is running. A controller is almost invariably placed at each end of the car and is familiar to every one as an upright cylindrical device with a cranklike handle on its top. The interior of an ordinary street-car controller is shown in Fig. 14. The wires from the trolley, from the field, from the armature, and from the different terminals of the series and shunt resistance are brought up under the car to terminals on a connecting board in the bottom of the controller. On this connecting board there is also a switch, which enables an injured motor to be cut out without interfering with the operation of the other. From the connecting board conductors are run to terminals called fingers, or wipes. Mounted on an insulating cylinder,

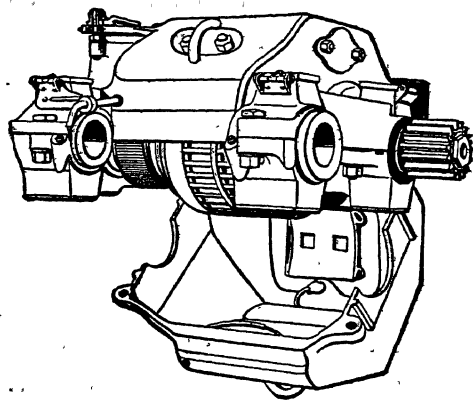


FIG. 13. RAILWAY MOTOR (G. E. FORM).  
Lower frame dropped, showing armature in position.

which may be revolved by the controller handle, are insulated sectors, which at various angular positions of the cylinder make electrical connections between various wipes and give the proper connections for the various points or notches.



A smaller cylinder connected to a reversing lever is situated to the right of the main cylinder. This has contact sectors which are arranged so as to enable the motorman to reverse the direc-

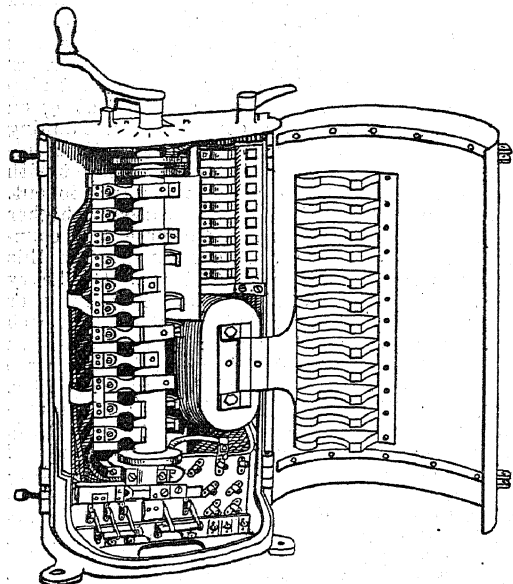


FIG. 14. CONTROLLER.

tion of rotation of both motors or to cut them out entirely.

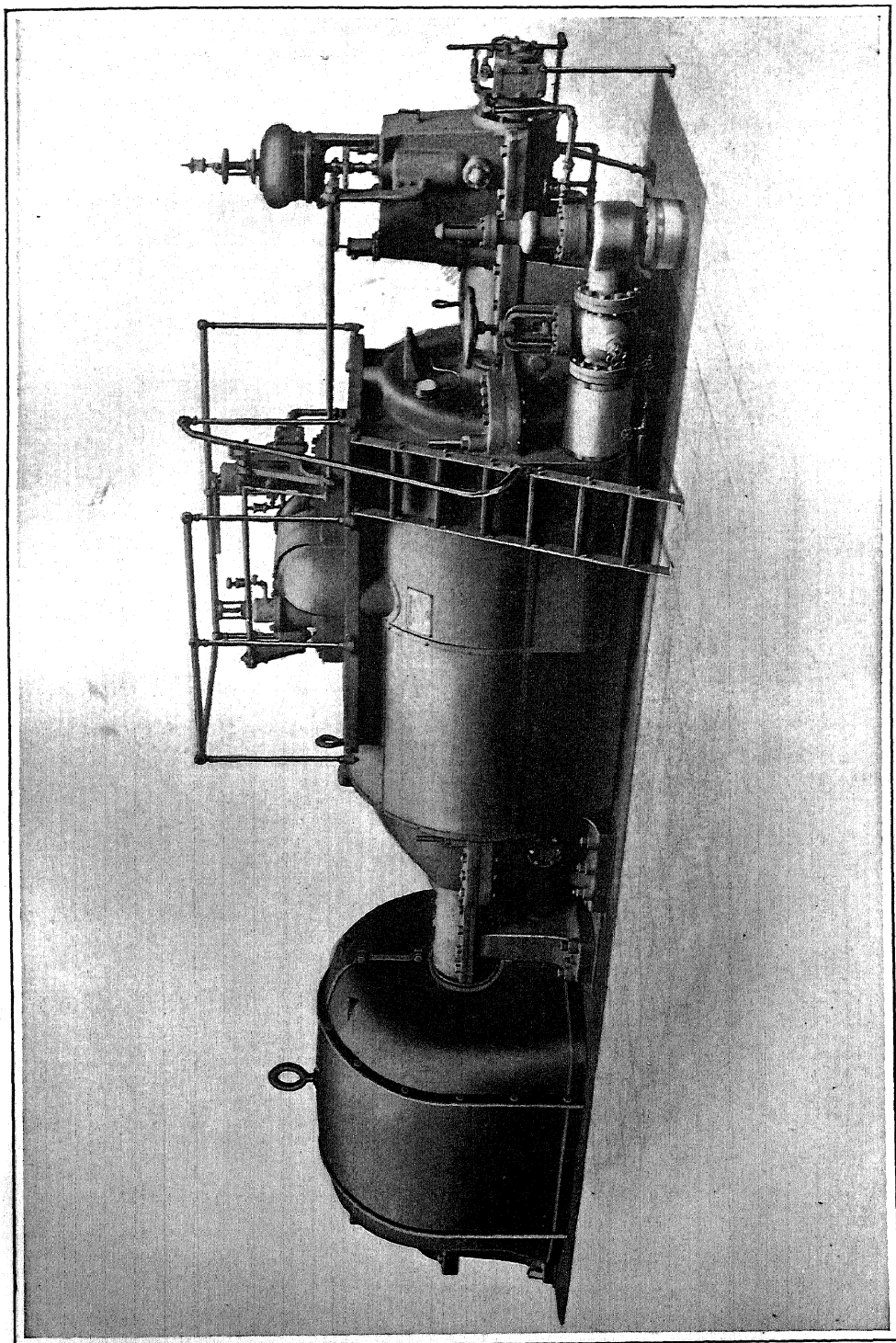
For power distribution in factories, both series and shunt motors are used. The series motor is employed where a powerful starting effort is required, as on cranes and hoists, but where close speed regulation is unimportant. The speed of the shunt motor may be controlled by controlling the applied electromotive force, as explained above, and the shunt motor is thus especially adapted for driving machines at constant speed or at speeds requiring definite adjustment. The characteristics of the compound-wound motor are intermediate between those of the shunt and series motors.

**Converters, Dynamotors, Boosters, etc.** Before passing to the subject of alternating machines proper, some types of machines possessing certain special properties which make them extremely useful devices under certain circumstances will be briefly considered. If the armature winding of any direct-current dynamo be tapped at two points which are opposite in phase, i.e., represented by a distance equal to that between two consecutive field poles, and these taps are led to two slip rings upon the shaft of the machine, alternating currents may be drawn therefrom. If the machine be run as a motor by supplying it with direct current delivered to the direct-current brushes, then alternating currents may be drawn from the slip rings. If, after the machine is brought up to full speed, alternating current of the same periodicity, or the same number of alternations per minute, as the machine will produce when run as a generator at this speed, be supplied to the slip rings, it will run as a synchronous motor, and direct current can be drawn from the regular direct-current brushes. To summarize, then: by simply tapping the armature winding of a direct current dynamo in the manner described,

a machine is produced which will act as an alternating-current generator as well; which will transform direct current into alternating, and which will also transform alternating current into direct current. According as the machine is used for the first, second, or third of these purposes it is called a double-current generator, an inverted converter, or a rotary converter. These machines are most commonly employed to transform alternating current into direct current and are commonly termed *rotary converters*. One of the principal uses of rotary converters is in electric-railway operation, where the distance of transmission is great. For long-distance transmission alternating current is desirable, since it may be raised easily to a higher potential, as will be explained below. The current for operating the car motors is usually, however, direct current, so that, when energy is transmitted in the form of alternating currents, rotary-converter substations are placed at intervals along the line to convert the alternating current to direct current for distribution to the trolley line. Rotary converters are usually operated on the three-phase alternating-current system as described below under *Alternating-Current Machines*. A *dynamotor* is a transforming device combining both motor and generator action in one magnetic field by employing two armatures or one armature having two separate windings. These machines enable one to take direct current from a system of supply at one voltage and deliver it at another voltage to a circuit in which it is to be utilized. They are used in electroplating works and for various minor purposes. *Motor generators* are transforming devices consisting of two machines, a motor and generator, mechanically connected. A *booster* is a machine inserted in series in a circuit to change its voltage and may be driven by an electric motor or otherwise. Boosters are used extensively in street-railway systems.

**Alternating-Current Machines.** Dynamo-electric machines for generating alternating current have been mentioned several times in the preceding pages. Before proceeding to discuss this type of dynamo it will be desirable to define the terms "single phase," "two phase," and "three phase," which will be frequently used in this discussion. All the alternators so far mentioned have been single-phase machines. If in Fig. 3 slip rings had been substituted for the commutator, the armature winding there shown would deliver a current which would reverse twice during each revolution of the armature. If another winding be added, the position of which on the armature is at right angles to the first, and this winding be also provided with slip rings, it will likewise deliver an alternating current which will be of the same periodicity as that delivered by the first. It is evident, however, that the current in the second winding will come to its maximum value one-quarter period later than in the case of the first winding. The currents in the two windings are said to differ in phase by a quarter of a period, and the machine is spoken of as a quarter-phase or two-phase machine. If the values of the currents are plotted as ordinates (verticals) in a diagram where the abscissæ (horizontal) represent time, the curves produced will be like those shown in Fig. 15, where the distance from *a* to *b* represents the time of one revolution, or two alternations, and the distance from *a* to *c* represents one-quarter of a revolution, or the time elapsing

## DYNAMO-ELECTRIC MACHINERY

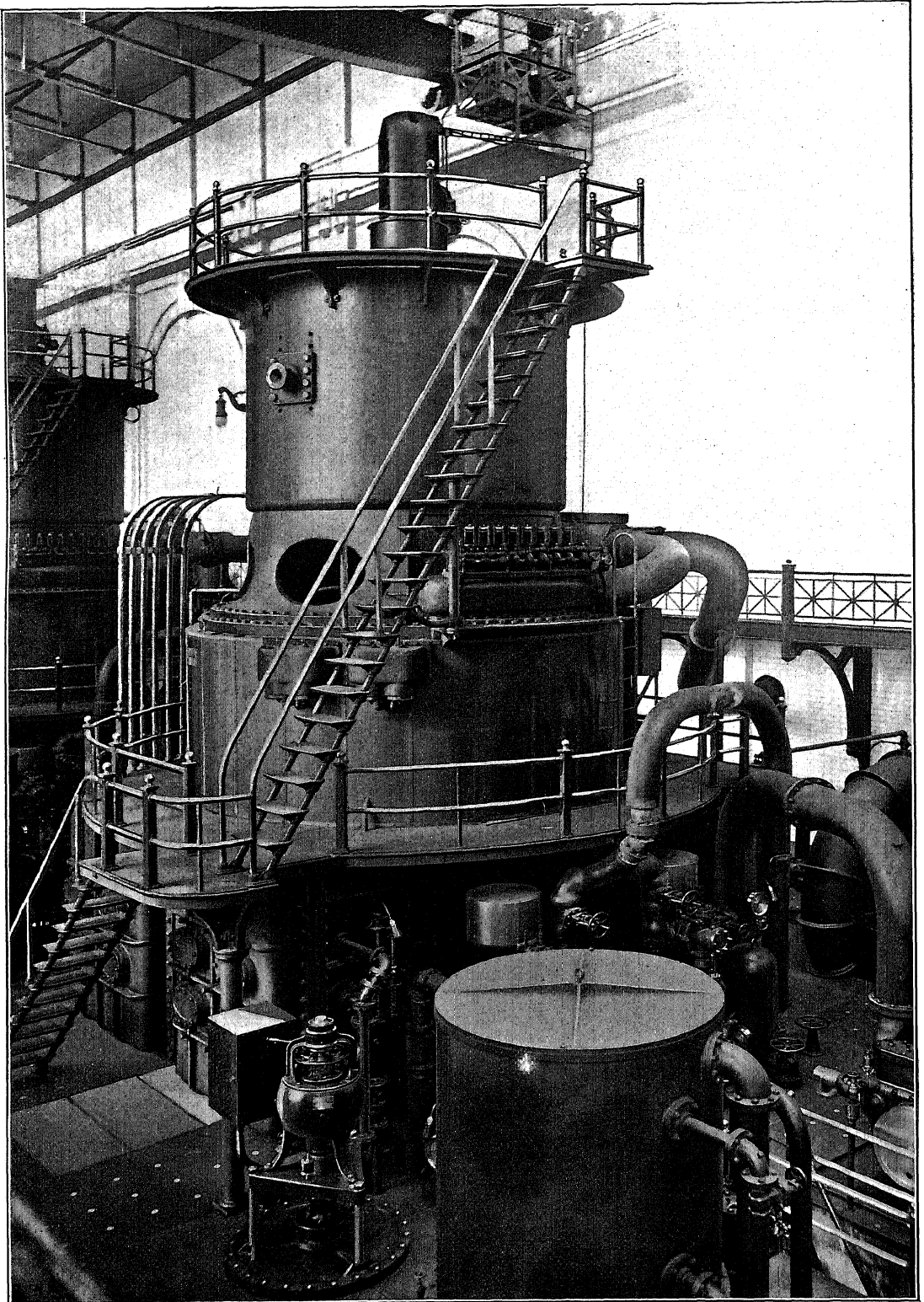


WESTINGHOUSE STEAM TURBINE GENERATOR UNIT

The Generator is shown on the left and the Turbine in the centre. The Turbine Installation requires much less space and a less massive foundation than the ordinary Generator directly connected to a reciprocating Engine.



DYNAMO-ELECTRIC MACHINERY



CURTIS VERTICAL TURBO-GENERATOR

FISKE STREET STATION, COMMONWEALTH EDISON COMPANY, CHICAGO, ILLINOIS

between the instant when the current in the first winding is at its maximum to the instant when the current in the second winding is zero. If about the circumference of the armature there were three wires spaced at equal distances, and these wires were connected at a common junction at one end of the armature and to three separate slip rings at the other end, the currents flowing in the three wires would reach their maximum at periods one-third of a revolution from each other, and the resulting curve diagram would be as shown by Fig. 16. To apply the explanation given above to multipolar machines, the terms "complete revolution" and "circumference of the armature" should be understood to mean time taken by a conductor to pass by two poles and space upon the armature covered by two poles. Also, while the explanation considers only alternating machines which have stationary fields and rotating armatures, it is evident that the rotative mobility of the two may be reversed. In fact, in most large machines directly connected to the prime motor, the field is the rotating part. In this case the armature connections are merely fixed taps, and the exciting current is supplied to the field through slip rings. In the inductor alternator both the field winding and the armature are stationary, the only revolving part being the inductor—a laminated iron core with

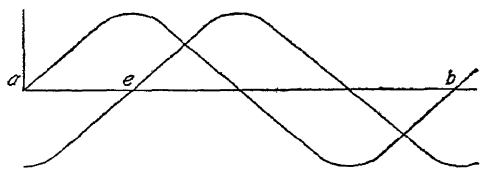


FIG. 15.

polar projections which cause the magnetic lines of force to cut alternately into and out of the armature coils and so induce electromotive forces in them.

The so-called "turbogenerator" is a type of dynamo-electric machine that merits particular mention, as it is becoming more and more extensively used, especially for large alternating-current generators. The lower limit to the size of a generator for a given output is fixed by the maximum speed for which the prime mover can be designed—at least this is true if the generator is directly connected to the engine shaft, and for large units this is the only practical way. The speed of a reciprocating engine of high power must necessarily be slow, and in consequence the size of the generator soon becomes prohibitive, both on account of the difficulties of construction and the space which the finished machine occupies. However, these difficulties are overcome by employing a steam turbine (q.v.) as the prime mover. The characteristic feature of such a machine is that it must be run at exceedingly high speeds, and in consequence the connected generators must be designed to withstand the enormous strains resulting from this high rotative speed. This is accomplished by making the revolving part as small in diameter as feasible and using in its construction only the very strongest material; in case of alternating-current turbogenerators the revolving part is invariably the field, the core of which is usually made of nickel steel and the field winding of insulated copper strap held in place by bars of phosphor bronze.

Alternating-current motors may be classed as *synchronous* and as *nonsynchronous*. The rotary converter above described represents quite well the first class. Such motors are not in extensive use, on account of the fact that they must be

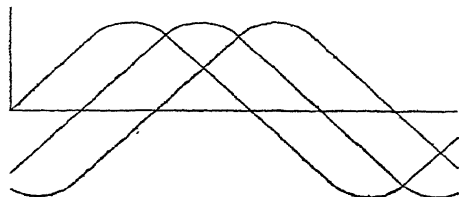


FIG. 16.

brought up to full speed before they can be thrown into circuit. They, of course, run at the same speed as, or keep in step with, the generator which is furnishing the current. Nonsynchronous motors are of two kinds, the induction motor and the recently developed alternating-current commutating motor. In order to explain the induction motor an interesting property of polyphase or multiphase current must be described. In Fig. 17 is shown, diagrammatically, a four-pole electromagnet. If a current is sent through the coils on the two poles *A* and *A'*, there will be established a magnetic field across from *A* to *A'* in the direction of the arrow No. 1. Similarly, if a current is sent around *B* and *B'*, a magnetic field will be established across from *B* to *B'* in the direction of arrow No. 2. If both currents are flowing at the same time and are of equal strength, the resultant field will be in the direction of arrow No. 3. Now, if the *A* current and the *B* current are alternating and differ in phase 90°, i.e., if the *A* current has its maximum value when the *B* current is zero, and vice versa, then starting with the *A* current at its maximum the magnetic field between the poles will at first be in the direction of arrow No. 1; then, as the *B* current increases and the *A* current decreases, the field will change in direction, until when the

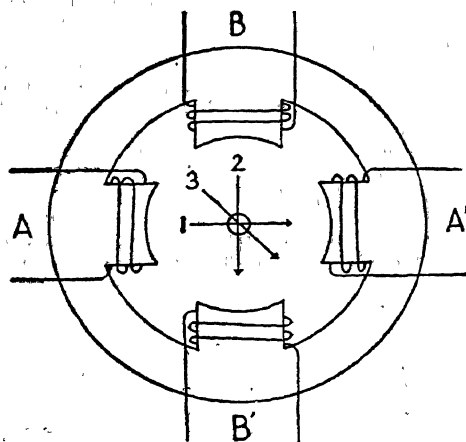


FIG. 17.

*A* and *B* currents are equal it will be in the direction of arrow No. 3; as the *A* current continues to decrease to zero, and the *B* current to increase to its maximum, the direction of the field will change into that of arrow No. 2; then as the *A* current takes a negative value and the *B* cur-

rent decreases from its maximum, the field will continue to change its direction, until, for a complete cycle of either the  $A$  or  $B$  current, the field will have taken all possible directions, about the point  $O$ ; in other words, the magnetic field will rotate with a period of revolution equal to the period of the current. If then an armature is mounted between the poles, and this armature is provided with a winding which is short-circuited upon itself, the moving magnetic field will induce currents in this winding. These currents will in turn set up a second rotating field tending to oppose the rotating field due to the fixed coils  $AA'$  and  $BB'$ , and the pull between the two fields will cause the armature to revolve. Such a device is called an induction motor. In actual practice the field, or stator, of an induction motor is provided with a so-called distributed winding similar to that on the armature of a direct-current motor, so that there are no polar projections as shown in the figure, but the effect of this winding is equivalent to that of the simple winding discussed. It will be obvious that three-phase currents could be used as well as two-phase currents. Similarly, induction motors are also made in small sizes, but the principle according to which they operate is somewhat more intricate than that governing polyphase motors. Polyphase induction motors are capable of being used for practically all the purposes to which shunt-wound direct-current motors are applied, and with proper controlling appliances may be used with more or less success in place of the series direct-current motors. They are simple in construction, have no moving contacts, and do not easily get out of order. They have been extensively employed in mills and factories, and in Europe they are used to propel electric-railway cars. Induction motors vary greatly in construction; the simple induction motor, however, is essentially a constant-speed machine. Like all other types of dynamo machine, the induction motor may be employed as a generator. To obtain this result, the armature must be driven faster than the revolving field, and polyphase currents must be supplied to the fixed element from some outside source to produce the requisite excitation.

The development of the alternating-current *single-phase series motor* is the result of the demand for an economical traction system for long-distance and heavy-railway work. The transmission of large amounts of electrical energy for any considerable distance is most economically accomplished by means of alternating currents: (See POWER, TRANSMISSION OF.) If direct-current motors are used, this energy has to be transformed by means of static transformers and rotary converters into direct current at a comparatively low pressure, and this low-pressure direct-current energy transmitted from the transforming station to the motor. The advantages resulting from the employment of a suitable alternating-current motor are the elimination of the rotary converters and their attendant expenses, and an increased efficiency in the secondary transmission, as the final reduction of pressure to the value required at the motor can be accomplished by means of a small transformer carried on the car. Neither the synchronous nor induction motor is suitable for this purpose, for neither of them possesses the two essential features of a traction motor—large tractive force at starting and high effi-

ciency over a wide range of speed. The three-phase induction motor is employed to some extent both in Europe and America, mainly in mountainous regions with fairly long runs between stops. Where starts and stops are frequent, a series type of motor has marked advantages, due to its great torque at low speeds.

An ordinary direct-current series motor will run on an alternating circuit, since the direction of rotation is independent of the direction in which the current passes through the motor (a direct-current motor can be reversed only by changing the connection of the field and armature leads relative to each other), but at a great reduction in efficiency and power factor, due to certain peculiarities of alternating currents of too technical a nature to be considered here. However, these difficulties can be largely overcome by suitably designing the various parts of the machine.

Two types of single-phase motors have thus been developed, the "series" motor and the "repulsion" motor. Both these types are alike in having an armature essentially similar in construction to that of the direct-current series motor. In the series type the field winding is similar to that of a direct-current machine, except that the iron used in the poles and yokes is laminated; the field and armature are connected in series. In the "repulsion" motor the field is similar to that of an induction motor; the brushes are short-circuited, and there is no electrical connection between field and armature. The armature acts like the secondary of a static transformer, and the brushes are set so as to maintain a constant repulsion between the primary (field) and the secondary (armature).

The controlling system for alternating-current motors contains no resistance, the necessary variations in pressure to secure a uniform acceleration at starting being accomplished by means of a device called a potential regulator, which is essentially a static transformer with its coils movable with respect to each other. In an alternate type of control the reducing transformer has a secondary winding with taps by which the number of active turns can be altered to give any desired voltage. The efficiency of these controllers is much superior to that of the direct-current resistance system.

For long-distance power transmission alternating currents are used almost exclusively, as a large alternating current of low potential may be converted into a small current of high potential by a transformer (q.v.), and by this means a great saving in the copper required in the transmission line may be accomplished. At the distant end of the line another transformation may be used to "step down" or reconvert the current to one of low potential. For long-distance transmission work three-phase currents are peculiarly adapted, as a three-phase current of a given potential may be transmitted with only three-fourths of the copper required for a single-phase, two-phase, or direct current working at the same pressure between wires. See POWER, TRANSMISSION OF.

**Bibliography.** Thompson, *Dynamo-Electric Machinery* (London, 1904); Sheldon, *Dynamo-Electric Machinery*: vol. i, *Direct-Current Machines* (New York, 1910); vol. ii, *Alternating-Current Machines* (ib., 1914); Morecroft, *Continuous and Alternating-Current Machinery* (ib., 1914); Franklin and Esty, *Elements of Electrical Engineering*, vols. i, ii (ib., 1911); Jack-

son, *Alternating Currents and Alternating-Current Machinery* (ib., 1913); *Standard Handbook for Electrical Engineers* (ib., 1910); Foster, *Electrical Engineer's Pocket Book* (ib., 1910); Steinmetz, *Elements of Theoretical Electrical Engineering* (ib., 1909).

**DYNAMOMETER** (from Gk. *dýnamis*, *dynamis*, power + *métron*, *metron*, measure). A device for measuring the force exerted in overcoming resistance and producing motion. The foot pound, as a unit of work, has for its factors the force acting and the distance through which it acts. The horse power, besides these factors, has a third—the time during which the force is exerted. Hence, in getting the data from which the work of a machine is to be calculated, we are to observe the force, the distance, and the time required to accomplish a certain result. Strictly speaking, the dynamometer indicates the first of these items, but it may be so arranged as to show both the others. Dynamometers are designed to indicate the force of *traction*, of *thrust*, or of *rotation*. A traction dynamometer consisting of some sort of spring balance may be interposed, e.g., between a team of horses and a reaper or a plow, to measure the force exerted by the horses in drawing the machine or on a larger scale may be used to measure the force exerted by a locomotive at the drawbar. A dynamometer for thrust can be connected with the screw shaft of a steamship to measure the force with which the screw is driving the vessel through the water. Rotary dynamometers measure the force of a shaft either by measuring the force required to hold the shaft steady, or by absorbing the *energy*, or by ascertaining the force the shaft transmits to other machinery. In testing the Melville-McAlpine turbine reduction gear use was made of a 6000-horse-power hydraulic absorption dynamometer, where by means of vanes the water was heated to boiling temperature by friction. The Prony brake is the most commonly used dynamometer of this form and is found described, with directions for using it, in Kent's *Mechanical Engineer's Pocket-Book* (8th ed., New York, 1913). Consult also Carpenter's *Experimental Engineering* (7th ed., ib., 1912), and particularly the *Transactions of the American Society of Mechanical Engineers*, vols. vii–xv inclusive, under the index heading *Dynamometers*.

**DYNAMOTOR.** See **DYNAMO-ELECTRIC MACHINERY**, *Converters*, *Dynamotors*, *Boosters*, etc.

**DYNE**, *dīn* (abbreviated from *dynam*, from Gk. *dýnamis*, *dynamis*, power). The unit of force of the C. G. S. system; i.e., it is such a force that under its action a body of mass 1 gram is given an acceleration unity. Bodies of all masses fall towards the earth with the same acceleration at any one place on the earth's surface, provided they are allowed to fall perfectly freely. (See **GRAVITATION**.) This acceleration for all places is about 980 on the C. G. S. system; therefore the *weight* of a body whose mass is *m* grams—i.e., the force of the earth acting on it, being the product of *m* and this acceleration of a falling body—is 980 *m* dynes approximately. The weight of 1 milligram is, then, 0.980 dynes, or nearly 1 dyne. Since a dyne is so small, a more common unit of force is a "megadyne," or 1,000,000 dynes, i.e.,  $10^6$  dynes. See **MECHANICAL UNITS**; **FORCE**.

**DY'ENFORTH, ROBERT SAINT GEORGE**

(1844–1910). An American soldier and lawyer, born in Chicago. He graduated at Breslau in 1861, served in the United States army in 1861–66, became major of volunteer cavalry, assistant inspector general and signal officer in the Department of the Missouri, and was several times brevetted. In 1866 he was correspondent of the *Chicago Post and Times* during the war between Austria and Prussia. He studied mechanical engineering at the University of Illinois in 1866–69, entered the U. S. Army in 1871, was examiner in chief during the administration of President Hayes, and assistant commissioner during that of President Arthur. He resigned in 1885 and practiced as a patent and corporation lawyer. In 1891 he carried on in Texas a series of experiments for the government, to condense water vapor into rain by violent explosions; he was, in consequence, popularly known as the "Rain Maker."

**DYRRHACHIUM**, *dīr-rā'kī-ūm*. See **DURAZZO**.

**DYSCROMATOPSIA**, *dīs-kró'mā-tóp'sī-ā*. Difficulty in distinguishing colors, or partial color blindness (q.v.).

**DYSENTERY** (Lat. *dysenteria*, Gk. *dysenteria*, *dysenteria*, dysentery, from *dys-*, *dys-*, bad + *énteron*, *enteron*, intestine). A form of disease of the large, rarely also in the small, intestine, attended by frequent and scanty discharges from the bowels, and differing from diarrhoea (q.v.) chiefly in being attended by marked fever and pain, as also by the presence of blood and mucus in the discharges. Two forms of dysentery are recognized by medical authorities—sporadic and epidemic. In *acute catarrhal colitis* an increase in mucus occurs, which is thrown off with epithelial cells, serum, and blood, ulceration occurring with swelling of the glands and formation of connective tissue. This is the ordinary form of dysentery, which is relieved by saline purgatives, astringent injections, opium, salol, and enemata of starch or hot water. *Acute infectious colitis*, or "tropical dysentery," is either caused by the presence of the *Amœba coli* ("amebic colitis") or by the presence of *Bacillus dysenteriae*, as shown by Shiga in 1897 and Flexner in 1899. Amœbic dysentery is considered a distinct disease by modern physicians. Its true nature was discovered by Lösch in 1875 and described by Kartulis in 1886. In tropical dysentery necrotic and suppurative processes may be set up in the liver and in the right lung. The symptoms are largely the same as in catarrhal colitis, except that they are more severe; the mortality also is high. Tropical dysentery is rarely seen in immigrants coming to the United States. It is endemic in southern Europe. There is a chronic catarrhal colitis. There is also a form of dysentery, known as "croupous colitis," in which there occurs formation of a false membrane over the mucous lining of the intestine. To the variety of dysentery in which inflammatory changes are the most marked in the lymph nodes, the name *nodular* or *follicular* dysentery is given. If necrosis of the mucous membrane be extensive, the colitis is termed *necrotic*. All cases of dysentery which do not improve under milk or peptonoid diet and injections of starch and hot water should be speedily put into a physician's hands. By the use of a specific serum Shiga reduced the mortality about one-third in bacillary dysentery. In amœbic dysentery ipecac in large doses has

long been considered a specific. Consult L. Rogers, *Dysenteries: Their Differentiation and Treatment* (New York, 1913).

**DYSLYSIN** (from Gk. *δυσ-, dys-,* hard + *λυ-σινός, \*lysinos,* soluble, from *λύειν, lyein,* to solve).  $C_{21}H_{38}O_8$ . An organic substance obtained by boiling cholic acid with hydrochloric acid for some time. It is a neutral resinous body, insoluble in water, alcohol, and the alkalis, but moderately soluble in ether. Small quantities of it are sometimes found in feces.

**DYSMENORRHEA**, *dīs-mēn'ōr-rē'ā*. See MENSTRUATION.

**DYSPEPSIA** (Lat. *dyspepsia*, Gk. *δυσπεψία, dyspepsia*, from *δυσ-, dys-,* bad + *πεπτός, pep-tos,* cooked, from *πέπτειν, peptein,* to cook). Disordered function of the stomach, resulting in impaired digestion. The symptoms are: feeling of pressure or weight after a meal, burning (*pyrosis*), accumulation of gas, headache, coated tongue, drowsiness, and general weakness and discomfort. There may be a diseased condition of the mucous membrane of the stomach (*gastritis*), with pain and vomiting in addition to the symptoms noted; there may be a deficiency in the hydrochloric and lactic acids in the gastric juice; there may be excessive production of these acids; there may be a rapid fermentation of the food, with the production of gas and toxins, causing great pain in the stomach, severe headache, palpitation of the heart, and frequent raising of gas, this condition being termed flatulent dyspepsia. There may be a general nervous condition, with waste of nerve energy, the stomach being the first organ to fail in its functions; this condition being termed nervous dyspepsia. Gout, or lithemia, may be a cause of dyspepsia. In many cases constipation is also a symptom, and the use of cathartics has made the dyspepsia worse. Treatment must be directed to the cause, and in all cases diet must be regulated and daily out-of-door exercise practiced. Indigestible or irritating food should be avoided, such as smoked or salted meat, smoked or salted fish, hot breads, all fried articles of food, generally potatoes and roots, sweets, pastry, and oatmeal. Tea and coffee and all alcoholic liquors should be avoided, in general. Food should be thoroughly masticated and eaten slowly. In some cases the stomach should be washed out every day or two. Bitter tonics, such as *-iryc' ninē*, are helpful, also creosote, carbolic ac'd, kola, ginger, and various digestants, such as pepsin and papoid, in certain cases. Management is better than medicinal treatment in many cases. Consult Bigg, *Indigestion, Constipation, and Liver Disease* (London, 1913). See INDIGESTION.

**DYSPHONIA** (Neo-Lat., from Gk. *δυσφωνία, harshness of sound*, from *δυσ-, dys-,* bad + *φωνή, phōnē, voice*, from *φάται, phanai,* to speak). Difficult speaking. It is attended with inflammation, huskiness, cough, expectoration, and sometimes ulceration. Rest of the vocal organs, muscular exercise, tonics, and change of air and scene, are helpful towards recovery. *Dysphonia clericorum*, or "clergyman's sore throat," is a glandular pharyngitis and laryngitis arising from the forcible and improper use of the voice. *Dysphonia puberum* is the term given to the changing voice at puberty, when it becomes harsh and inharmonious, and "breaks" when used. *Dysphonia spastica*, or "speaker's cramp," is a spasm of the muscles of phonation or respiration. In this variety of dysphonia there are

sudden changes to a high pitch, the voice becomes jerky, or aphonia occurs.

**DYSPNŒA**, *disp-nē'ā* (Lat., from Gk. *δύσπνοια, dyspnōia*, from *δυσ-, dys-,* bad + *πνοή, pnoie,* breathing). Difficult breathing; in popular speech "shortness of breath." *Dyspnœa* may be due either to lack of oxygen, to excess of carbon dioxide, or to the presence in the blood of certain products of muscular activity (*dyspnœa of exercise*). The condition may be either inspiratory or expiratory, or both, and the chief causes are obstruction of the nose, throat, larynx, trachea, and bronchi; diseases of the lungs or pleura; or pressure upon the diaphragm by gas, fluid, or tumors in the abdomen. It is also a symptom of anæmia, paralysis of the muscles of respiration, or pain in or about the chest. Diseases of the heart and kidneys are often attended with *dyspnœa*.

**DYSPROSIUM**. A chemical element contained in small quantities in ytterbite and obtained from this, in the form of the oxide (*dysprosia*), by Lecoq de Boisbaudran in 1886. Efficient methods of isolating dysprosium from its concomitant elements were described by Urbain in 1900, 1904, and 1906. Dysprosium (symbol, Dy; atomic weight, 162.5) forms a white oxide of the formula  $Dy_2O_3$ ; a chloride of the formula  $DyCl_3 + 6H_2O$ ; a nitrate (similar to bismuth nitrate) of the formula  $Dy(NO_3)_3 + 5H_2O$ ; a sulphate of the formula  $Dy_2(SO_4)_3 + 8H_2O$ ; and several other salts. The salts have a slight greenish-yellow tint. Dysprosium is remarkable as the most paramagnetic element known, its oxide being nearly 13 times more magnetic than the oxide of iron.

**DYS'TELEOL'OGY** (from Gk. *δυσ-, dys-,* bad + *τέλος, telos,* end + *-λογία, -logia,* account, from *λέγειν, legein,* to say). The doctrine of purposelessness, or of the absence of final causes in nature. The term is sometimes used in the sense of frustration of purpose, as when cross pollination in plants is prevented because an insect punctures a nectary instead of entering the floral opening. See TELEOLOGY.

**DYSURIA** (Lat., from Gk. *δυσουρία, dysouria*, from *δυσ-, dys-,* bad + *ούρον, ouron,* urine). A difficulty of passing urine, which may depend on a variety of causes. See BLADDER; STRICTURE.

**DYTISCIDÆ**, *dī-tīs'ī-dē*. See DIVING BEETLE.

**DYVEKE**, *du've-kā* (1491-1517). The mistress of Christian II of Denmark. She was born in Amsterdam, the daughter of Sigbrit Willums, an innkeeper, in whose inn at Bergen Christian first met her. Dyveke followed him to Denmark in 1507 and until her death continued her relations with him. She was hated by the nobles and, it is supposed, met her death by poison administered to her in cherries by one of them. Christian cruelly avenged her death and retained her mother as his chief counselor till his fall. Dyveke has been made the subject of many tragedies, novels, and poems. Consult Hauch, *Wilhelm Zabern* (Copenhagen, 1848), and Reikhoff, *Dyveke*, a tragedy (Berlin, 1843).

**DZEREN**, *džē'rēn*. The Mongolian name for a large Central Asian "goitred" antelope (*Gazella gutturosa*), having extremely pale horns and a protruding crop.

**DZIATZKO**, *dschäts-kō*, KARL FRANZ OTTO (1842-1903). A German librarian and scholar, born in Neustadt, Silesia. He studied at the universities of Breslau and Bonn; in 1871 he be-

came librarian of the University of Freiburg, in 1872 librarian at Breslau, and in 1886 librarian and professor of library science at Göttingen. Among his publications are a text edition of the comedies of Terence (1884), *Instruktion für die Ordnung der Titel im alphabetischen Zettelkatalog der königlichen und Universitätsbibliothek zu Breslau* (1886), used, with comparison of other works, as the basis of K. A. Linderfelt's *Eclectic Card Catalog Rules* (Boston, 1890), and *Untersuchungen über ausgewählte Kapitel des antiken Buchwesens* (1900).

**DZIERZON**, dzēr'tsón, JOHANN (1811-1906). A German apiculturist. He was born at Lobkowitz, Upper Silesia, studied theology at Breslau, and was pastor at Karlsmarkt from

1835 to 1869. Afterward he devoted himself entirely to apiculture, a subject to which he had for many years given considerable attention. In order to facilitate his investigations Dzierzon constructed a hive with detachable cells and thus made the discovery that the eggs for the propagation of the drones required no fertilization, but could be generated by the queens or even by the working bees. (See PARTHENOGENESIS.) His publications include *Theorie und Praxis des neuen Bienenfreundes* (1848) and *Rationelle Bienenzucht* (2d ed., 1878).

**DZIGGETAI**, dzig'ge-tā or -tāi, or DJIGGETAI. Mongol names of one form of the Asiatic wild ass. See ASS.

**DZUNGARIA**, dzōōŋ-gü'rè-ä. See SUNGARIA.



# E

**E**

The fifth letter and second vowel in the Roman and most other alphabets. Its form is derived from the Phœnician sign p through the Greek and Roman scripts. The Semitic name for this character, *he*, is not a word with recognized signification, as is the case with most of the other letters. See ALPHABET; LETTERS.

**Phonetic Character.** The Greeks had two characters to represent the short and the long sound of our *e* in *let* and *they*. The short one, *ε*, was called *epsilon*; the long one, *η*, was designated as *eta*. In Latin also there were both a short and a long *e*, just as there were in primitive Indo-Germanic. In Sanskrit the sound of *e* was long, but it was shortened under certain circumstances in Pāli and in the vernaculars. Historically the Indo-Germanic short *é* becomes *ä* in Sanskrit, *ē* in Greek and Latin, as in Idg. \**bhērō*, 'I bear,' Skt. *bhārāmi*, Gk. *φέρω*, Lat. *fero*. The original long *ē* becomes Skt. *ā*, Gk. *η*, Lat. *ē*; thus, Idg. \**plē*, 'fill,' Skt. *prā-ta*, 'full,' Gk. *πλήρης*, Lat. *plēnus*. Both long and short Indo-Germanic *e* appear under certain conditions as long and short *o* respectively. Thus, from Gk. *τρέπω*, 'I turn,' we have the noun *τρέπος*, 'turn'; similarly the long *ē* (*η*) in Gk. *πατήρ*, 'father,' appears as *ο* (*ω*) in *προπάτωρ*, 'forefather.' This phenomenon is called vowel gradation. In English, the single character *e* is used to represent a variety of sounds—*get*, *he*, *her*, *there*, and the like—and its employment to indicate that the preceding vowel is long, as in *ston(e)*, from A.S. *stān*, is a device inherited from an earlier period of misspelling in the language. The frequency of *e* in English is largely due historically to its being the indiscriminate or indefinite vowel into which the final endings *a*, *o*, *u* of the Anglo-Saxon period were weakened. The case in German is somewhat similar. In words borrowed from the Romance languages mute *e* usually takes the place of Greek or Latin final syllables, e.g., *muse*, Lat. *musa*; *bile*, Lat. *bilis*; *cone*, Lat. *conus*.

**As a Symbol.** *E* in music is the third tone in the natural scale of C; in the treble clef it is written on the first line or fourth space, and in the third space or the first added line below in the bass clef. As an abbreviation, *E.* stands for East.

**EA, ENKI, or AE.** A Babylonian deity of Sumarian origin. With Anu (q.v.) and Ellil-Bel he forms the highest triad in the Pantheon. He is associated with the ocean, and the earliest

seat of his worship seems to have been Eridu (modern Abu Shahrein) at a time when this city was on the Persian Gulf. Of all the gods he has the highest reputation for wisdom. He is a creator-god, forming man; and a friend of man (see ADAPA; DELUGE). This has led some scholars to identify him with Oannes (q.v.); Damascius gives his name as *ʿAos*, *Aos*, and some texts read *Ae*, which may have been the pronunciation. His consort was Dambina. Consult: Zimmern, *Die Keilinschriften und das Alte Testament: Religion und Sprache* (Berlin, 1902); Jastrow, *Die Religion Babyloniens und Assyriens* (Giessen, 1902-12); G. F. Moore, *History of Religions* (New York, 1914).

**EA-BANI**, ā'a-bā'nē. See ENGIDU.

**EACHARD**, ēch'ərd, JOHN (1636-97). An English clergyman and writer. He was educated at Cambridge, where he became master of Catharine Hall (1675), and for two terms was vice chancellor of the university. He published a number of satirical attacks upon the clergy, among them *The Ground and Occasions of the Contempt of the Clergy Inquired into, in a Letter to R. L.* (1670). In a similar vein of satire he attacked the philosophy of Thomas Hobbes in *Mr. Hobbes's State of Nature Considered* (1672).

**EADIE**, ē'di, JOHN (1810-76). A Scottish United Presbyterian theologian, born at Alva, Stirling-shire, and educated at the University of Glasgow and in the Divinity Hall of the Secession church (later United Presbyterian). He was licensed in 1835 and preached in Glasgow from 1835 till his death, June 3, 1876. From 1843 he was a synodical professor of biblical literature in the United Secession Divinity Hall in Glasgow, and his fame rests upon his writings in this department. Many had a very wide sale and are still in use, as his condensed edition of *Cruden's Concordance* (1839); *Biblical Cyclopædia* (1848; new ed., revised, 1902); *An Analytical Concordance to the Holy Scriptures* (1856); *Ecclesiastical Encyclopædia* (1861). He prepared commentaries upon the Greek text of Ephesians (1854), Colossians (1856), Philipians (1857), Galatians (1869), 1 Thessalonians (1877). He was a member of the New Testament Company of the Bible Revision Committee and in that connection published his important and interesting work. *The English Bible: An External and Critical History of Various English Translations of Scripture, with Remarks on the Need of Revising the English New Testament* (1876). He collected a remarkable library, which is now kept intact as the Eadie

Library in the United Presbyterian College in Glasgow. For his life, consult Brown (London, 1878).

**EADMER** (ēd'mēr) OF CANTERBURY (?-1124). An English monk and chronicler of the early twelfth century. He belonged to the Benedictine monastery at Canterbury and was a devoted friend of Anselm, Archbishop of Canterbury, from 1093 to 1109. In 1120, at the request of King Alexander I, he went to Scotland and was chosen Bishop of St. Andrews. The question of lay investiture of ecclesiastical benefices was then a burning one, and there were controversies as to jurisdiction between St. Andrews, Canterbury, and York. The outcome was that Eadmer returned to England unconsecrated. He became precentor of Canterbury and died, it is supposed, in January, 1124. His most valuable works are the *Historia Novorum*, or history of his own times, and his life of Anselm. They are both in the same volume of the "Rolls Series" (London, 1884), ed. by Martin Rule. His verses on St. Dunstan, St. Wilfred, St. Odo, St. Bregwin, and St. Oswald are published in Wharton, *Anglia Sancta*. His *Tractatus de Conceptione Sanctæ Mariæ* is republished (St. Louis, 1904). Consult Grub, *Ecclesiastical History of Scotland* (Edinburgh, 1861).

**EADMUND**, ēd'münd. See EDMUND.

**EADS**, ēdz, JAMES BUCHANAN (1820-87). An eminent American engineer and inventor. He was born in Lawrenceburg, Ind., but removed to St. Louis in 1833, became a clerk first in a dry-goods house and then on a Mississippi steamboat in 1839, and, having studied engineering by himself, set out to solve some of the problems of navigation on that river. By the outbreak of the Civil War he had achieved fame and a fortune and was accounted such an authority on everything pertaining to the Mississippi and its navigation that, soon after the fall of Fort Sumter, he was called to Washington to consult with President Lincoln and his cabinet as to the practicability of maintaining a fleet of light ironclads on the Western rivers. Later in the year 1861 he obtained the government contract for the construction of such a fleet and achieved the remarkable feat of placing in the water, fully equipped, seven ironclad river gunboats, largely of his own designing, in the short space of 100 days. It was with these gunboats, a month before the struggle between the *Merrimac* and the *Monitor*, that the capture of Fort Henry was effected. From 1867 until 1874 Eads was engaged in the construction of the steel arch bridge across the Mississippi at St. Louis, which ranked for many years as one of the finest bridges in the world. After the completion of this work he began studying the problem of deepening the channel at the mouth of the Mississippi and finally persuaded the government to allow him to undertake the enterprise at his own risk. His plan, which provided for the construction of jetties, was carried out successfully and was the crowning achievement of his career. The latter years of his life were spent in extensive engineering operations both in America and Europe, and the planning of a ship railway across the Isthmus of Tehuantepec. In 1884 he received the award of the Albert medal conferred by the British Society for the Encouragement of Arts, Manufactures, and Commerce, he being the first American to receive the award. Consult How,

James B. Eads (Boston, 1900), one of the "Riverside Biographies."

**EADWINE; EADWIG**. See EDWIN, EDWY.

**EAGAN**, ē'gan, CHARLES PATRICK (1841- ). An American soldier, born in Ireland and brought up in San Francisco. He entered the Federal army from civil life in 1862, with rank of first lieutenant, and in 1866 he was appointed to the United States army, with rank of second lieutenant, and by 1900, when he retired, had risen to the grade of brigadier general and commissary general. During the Spanish-American War he issued among rations designed for forces in Cuba canned meats said to be unfit for food. In 1899 he was court-martialed for violent and abusive language before the War Investigation Committee regarding General Miles, commander in chief of the army, and was sentenced to a suspension of six years from duty and military honors. Later he was retired at his own request.

**EAGLE** (OF. *egle*, *aigle*, Fr. *aigle*, It. *aquila*, from Lat. *aquila*, eagle, from *aquilus*, dark brown; connected with Gk. ἀχλὺς, *achlys*, mist, darkness, Lith. *aklas*, blind). Any member of a group of birds of prey, variously defined, but typified by the genus *Aquila*, which contains the largest and most powerful of the Falconidae. The subfamily Aquilinae includes several genera and over 40 species. From the most ancient times the eagle has been universally regarded as the emblem of might and courage, and, like the lion, it has been fancifully invested with other attributes of greatness such as men thought to harmonize with these. Its extraordinary powers of vision, the vast height to which it soars in the sky, the wild grandeur of the scenery amid which it loves to make its abode, and perhaps also its longevity, have concurred to recommend it to poetic regard. It was associated with Jupiter in the Roman mythology, and its figure on the standards of certain Roman legions has descended to the national ensigns of the United States, Germany, Russia, etc.

True eagles have the beak not curved from the very base, like the true falcons, nor notched on the edge; neither are their wings so long in proportion to their size; their legs are very robust; their claws curved, sharp, and strong. In the most restricted use of the generic term *Aquila*, the true eagles (of which the golden eagle may be taken as a type) have a rather short bill, curved from the cere, with the edge of the upper mandible slightly sinuate, the tarsi short and feathered down to the toes. This last character distinguishes them at once from their nearest allies—the sea eagles of the genus *Haliaeetus*. Nine species of true eagles are well distinguished, although in this, as in allied genera, much confusion has arisen from the diversity of plumage at different ages. Only one of them occurs in North America. This is the golden eagle (*Aquila chrysaetus*), of which the "ring-tailed" eagle is the young. It is 30 to 35 inches in length, and 6½ to 7 feet in spread of wing; the female is rather larger than the male. The color is dark brown, in some parts almost black; the head and back of the neck in mature birds are covered with pointed feathers of a golden-red color; young birds have a considerable part of the tail white; the bright-yellow cere and feet give it its name. The golden eagle is the largest of the European eagles and is found throughout Europe, Asia (north of the Himalayas), and most of North America. It prefers mountain-

ous districts, and usually only one pair exists within a relatively extensive area. These eagles are rare east of the Mississippi, but are occasionally seen, especially in winter. They build a coarse nest of large sticks on cliffs or rocky ledges in the mountains and lay two or three eggs, dull white, blotched, and speckled with brown. A great quantity of food is required to support a pair of these birds and their two or three young ones; and not only hares, game of every kind, and lambs are carried to the aerie, but larger animals are sometimes attacked.

The imperial eagle (*Aquila heliaca*) is usually regarded as that from which the Greeks and Romans adopted their symbolism and ranges from the eastern Mediterranean to China. It is somewhat smaller and darker than the golden eagle and seems to be less noble in its feeding habits and behavior; indeed, an impartial judgment must concede that the eagles do not nearly so well deserve the admirable qualities attributed to them by poetry and romance as do many of the lesser falcons—they are, in truth, not far removed from vultures in both structure and disposition. Much smaller, not exceeding 25 inches in length, are the spotted eagles (*Aquila maculata* and *Aquila clanga*) of central and southern Europe; while other less-prominent species are the tawny eagle (*Aquila rapax*) of Africa, the Indian tawny eagle (*Aquila vindhiana*), and the vulturine eagle (*Aquila verreauxi*) of South Africa, which is marked by a white rump and must be distinguished from the eagle vulture (q.v.). See also HAWK EAGLE.

**Sea Eagles.** Next in importance come the sea eagles or ernes of the genus *Haliaeetus*, which haunt coasts and large river courses and feed mainly upon fish in all parts of the world. Here belong the American white-headed or "bald" eagle, the national emblem of the United States (*Haliaeetus leucocephalus*)—an unfortunate choice when its predatory methods are considered. This eagle originally was numerous all over North America and still survives near the coast, around the Great Lakes, and along the larger rivers in considerable numbers, wherever it is not too ruthlessly persecuted. It is nearly as big as the golden eagle, but is not feathered to the toes, and its head, neck, and tail, after the third year, are perfectly white. It does not migrate, except from the most northerly, ice-bound portions of its range, and is indeed a home-keeper. A single pair sometimes occupying the same great nest of sticks, repaired each season, for many years in succession, followed perhaps by their descendants, for nests are known (one is near Cleveland, Ohio) which have not been vacant for nearly a century. Two is the usual number of eggs. This eagle feeds upon fish mainly. For the most part this is picked, dead or dying, from the surface or shore; bald eagles have always abounded in the neighborhood of Niagara Falls, because of the constant supply of fish found there, killed by going over the falls or being caught in the whirlpools below. They also regularly attack fish hawks and compel them to drop what they have caught. When fish are not obtainable, they eat carrion or kill small birds and mammals, as do the buzzard hawks, now and then capturing poultry.

The sea eagles of the Old World are larger than the bald eagle. The most familiar is the white-tailed erne (*Haliaeetus albicilla*), now nearly exterminated from Great Britain, except

in the far north of Scotland, but a familiar sight on the coasts of the Hebrides and thence eastward throughout Europe and most of Asia. In Siberia and Kamchatka still greater species are found, Steller's sea eagle, which ranges from China and Japan to the Aleutian Islands, attaining a length of 41 inches—the largest of its tribe. Africa has several species.

**Crested and Other Eagles.** Members of several allied genera are usually called eagles. A remarkable one is the "bataleur" (*Helotarsus ecaudatus*), of Africa, whose plumage is most strikingly variegated with maroon, black, and gray, and whose head is covered with large up-standing feathers; its food is mainly snakes and lizards. The buzzard and harrier eagles of the genera *Batastur* and *Circæus*, whose several species are African and South Asiatic, are also fond of a reptilian diet; while the large handsome birds of an Oriental genus (*Spilornis*) are usually called by natives "serpent eagles" (q.v.); the most conspicuous of these is the "one" (*Spilornis holospilus*), the whole plumage being brown, spotted with white. Several forms of handsome crested eagles are African and East Indian, and much that is interesting might be related of them and of the hawk eagles, did space permit. Australia possesses a single and peculiar species in the carrion-feeding wedge-tailed eagle (*Uroaëtus audax*); and in the fierce tropical harpies (genus *Thrasastus*) South America has representatives of this family almost equaling in size and surpassing in courage and power those of all the rest of the world. See HAWK EAGLE.

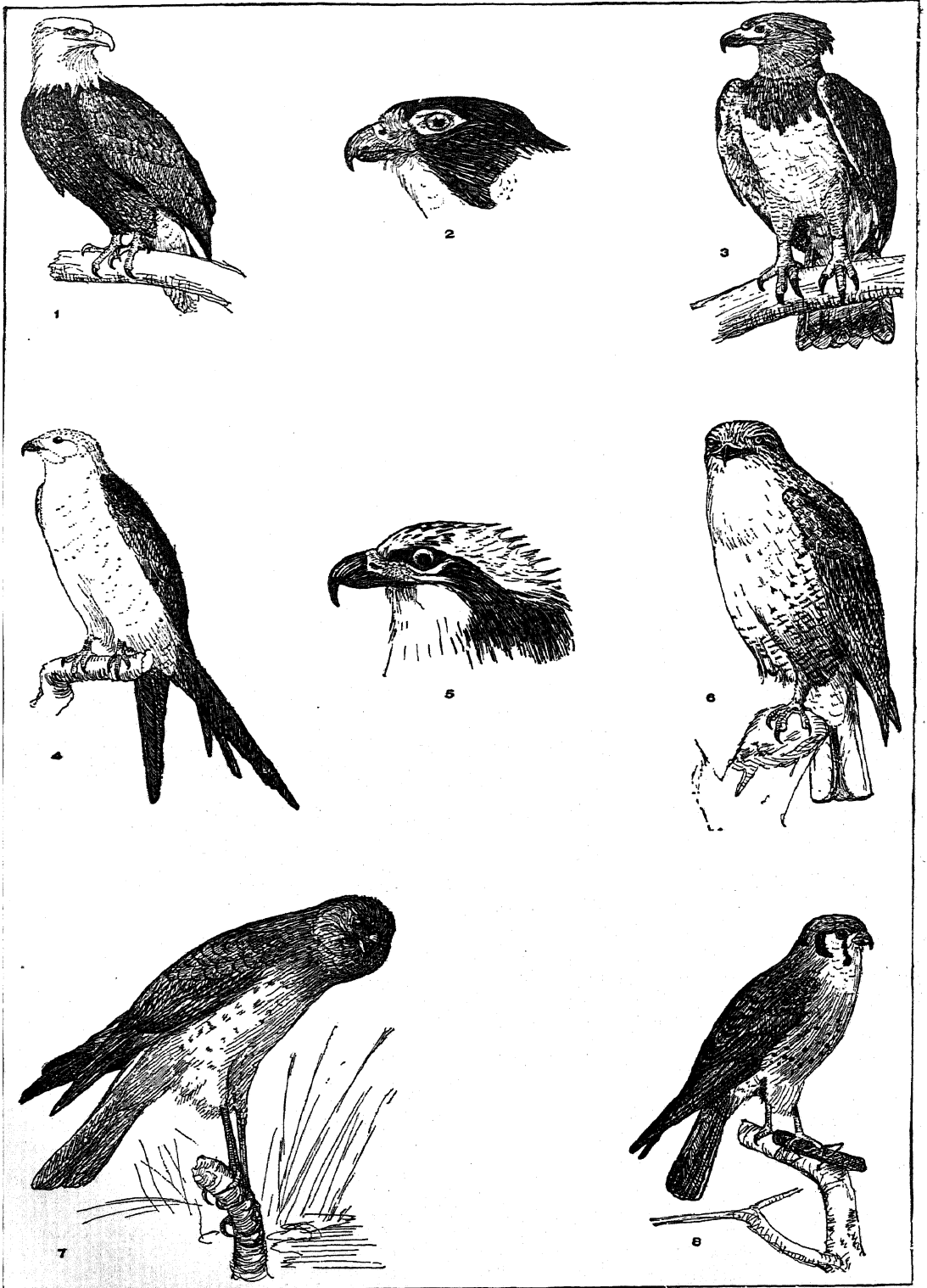
The literature relating to eagles is little separated from that of birds generally, as outlined under BIRD. For the limited use made of eagles in falconry, where they were counted "ignoble," see FALCONRY. See Plate of EAGLES and HAWKS.

**EAGLE.** A military standard, used by various nations in ancient times. The Persians, in the time of Cyrus the Younger, used an eagle on a spear as a standard. For some time used the eagle, the wolf, the boar, the horse, and the minotaur for standards, but afterward abandoned the last four and confined themselves to the eagle. The Roman eagle, sometimes of gold, but more frequently of silver, was about as large as a pigeon with extended wings and was borne on the top of a spear or pole, with a crossbar or a metal plate or a shield to support it. Often the eagles were represented as holding thunderbolts in their talons; they usually bore the name of the legion to which they severally belonged. The lower end of the pole was pointed, so that the standard could be set in the ground.

**EAGLE.** A support of entry on the Yukon River, in Alaska, near the Canadian boundary (Map: Alaska, L 3). It is a trade centre for Fortymile and other mining camps. Fort Egbert, a garrisoned post, adjoins the town. Pop., 1910, 178.

**EAGLE, BLACK, ORDER OF THE.** An order of chivalry in Prussia. It was founded by the Elector of Brandenburg, Jan. 18, 1701—the day of his coronation as King of Prussia. The number of knights, in addition to the royal family, was originally 30, but it is now unlimited. The order is conferred for distinguished merit in the military or civil service of the state and carries with it a patent of nobility. The insignia consist of a Maltese cross of blue enamel and a black eagle displayed between the

# EAGLES AND HAWKS



1. BALD EAGLE (*Haliaeetus leucocephalus*).
2. DUCK HAWK or PEREGRINE FALCON (*Falco peregrinus anatum*).
3. HARPY EAGLE (*Thrasaetus harpyia*).
4. SWALLOW-TAILED KITE (*Elanoides forficatus*).

5. OSPREY or FISH HAWK (*Pandion haliaetus*).
6. NORTHERN ROUGH-LEG (*Archibuteo lagopus sancti-johannis*).
7. MARSH HARRIER (*Circus hudsonius*).
8. SPARROW HAWK (*Falco sparverius*).



arms of the cross. On a circular plaque in the centre is the royal cipher F.R., with a laurel branch below and the words *Suum cuique* (To each his own). The cross is suspended by a broad ribbon of orange color hung across the left shoulder, and with it is worn an embroidered silver star fastened on the left breast. The centre of the star shows a black flying eagle with a laurel wreath and thunderbolt and the same legend as the cross. Only reigning princes and Knights of St. John may wear any other order with the eagle, which is the highest decoration in Prussia.

**EAGLE, RED, ORDER OF THE.** A Prussian order, founded in 1734 by the Margrave George Frederick Charles of Bayreuth, as a reorganization of the *Ordre de la Sincérité*. The order was raised in 1791 by Frederick William II to the rank of second in the monarchy. All the Knights of the Black Eagle were received into this new order, and it was afterward decreed that only those who had been decorated with the Red Eagle in the first instance could receive the Black. In 1810 two more classes were added to the order, and in 1830 the second class was subdivided into two. The badge consists of a white Maltese cross with red eagles between the arms, in the centre a golden plaque with the cipher F.W.R. and the motto *Sincere et constanter*. The ribbon is white, with two orange stripes.

**EAGLE, JAMES PHILIP** (1837-1904). An American soldier in Maury Co., Tenn. He served in the Confederate army from 1861 to 1865 and had risen to the rank of lieutenant colonel at the close of the war. In 1870 he became a Baptist minister, and he was president of the Arkansas State Baptist Convention for 20 years (1878-98) and also served as chairman of its executive board. He was a member of the convention which framed the constitution of Arkansas (1874) and served four terms in the State Legislature, being elected Speaker in 1885. He was Governor of Arkansas from 1889 to 1893.

**EAGLEGROVE.** A city in Wright Co., Iowa, 19 miles northeast of Fort Dodge, on the Chicago Great Western and the Chicago and Northwestern railroads (Map: Iowa, D 2). It is in an agricultural region, producing corn, oats, hogs, and cattle. The city contains a Carnegie library, a hospital, and railway shops. Eagle Grove was incorporated in 1882 and is governed by a mayor, elected biennially, and a unicameral council. The water works, comprising numerous artesian wells, are owned by the municipality. Pop., 1900, 3557; 1910, 3387.

**EAGLE ISLE.** See **ACHILL**.

**EAGLE OWL.** The name most often given in Europe to the great horned owl (*Bubo bubo*), representing a group of large, fierce owls of the Northern Hemisphere generally, of which the American great horned or hooting owl is a familiar example. They are characterized by a somewhat incomplete facial disk, two tufts of feathers (*horns* or *egrets*) of considerable size on the head, ears with small external openings, legs and toes covered with feathers, short, strong, curved bill, and long, curved, sharp claws. To this genus belong the largest of the nocturnal birds of prey. The eagle owl of Europe approaches in size (26 to 28 inches) the golden eagle and preys on quadrupeds such as hares, rabbits, and young deer, and on grouse and partridges. It seizes its prey with its feet and

seldom touches it with the bill till its struggles are over. It is an inhabitant of many parts of Europe and Asia, but it is rare in Great Britain. The eagle owl of America (*Bubo virginianus*), the great horned owl, is very similar to this species, but of inferior size. It does not scruple to attack half-grown turkeys and often succeeds in making them its prey. It is found in almost all parts of both North and South America and is not migratory. This sedentary habit has resulted in a number of variations and characters which have led to its separation into eight or more races. Eastern Asia has some allied species.

The habits of all these birds are essentially similar and differ from those of the smaller owls (see **OWL**) only in their greater strength and boldness. They lay two or three white eggs, but an East Indian species (*Bubo coromandus*) is remarkable in laying sometimes distinctly spotted eggs. In northern regions the eggs are laid in March or in February and often incubated amid violent snowstorms. This owl is often seen in menageries. Its note is a deep, loud, two-syllabled hoot, but is varied sometimes into a hoarse, neighing laugh. Consult: Dresser, *Birds of Europe* (London, 1879), and other ornithologies (see **BIRD**) for Old World species; Fisher, *Hawks and Owls of the United States* (New York, 1893); Beebe, *Owls of the Nearctic Region* (New York, 1907); Dawson, *Birds of Washington* (Seattle, 1909); Sclater and Hudson, *Argentine Ornithology* (London, 1888). See **PLATE OF OWLS**.

**EAGLE PASS.** A city and the county seat of Maverick Co., Tex., 169 miles west-southwest of San Antonio, on the Southern Pacific and the Mexican International railroads, and on the Rio Grande (Map: Texas, B 5). It is in a coal-mining, irrigation-farming, and stock-raising region, ship-canvas, hides, and wool, and has lumber and brick yards. Being the port of entry for the Saluria district, it enjoys a flourishing international trade, which was important during the Civil War. The city has a fine Federal building. The commission form of government has been adopted. Pop., 1910, 3536.

**EAGLE RAY** (so called from the winglike shape of the pectoral fins). A large ray of the family Myliobatidae, and especially *Myliobatis freminvillei*, of the warmer parts of the Atlantic Ocean. In this genus the disk is broad and sharply angular in outline; the cephalic fins form a soft, convex appendage before the snout; the tail is long and slender, giving the name "whip ray" to some species. The habits and food are similar to those of sting rays. See **RAY**.

**EAGLES, ORDER OF.** A fraternal organization, founded in 1898 and having its general offices at Kansas City, Mo. In 1914 it included one grand aerie and 1545 subordinate aeries. There were 347,569 members in that year. The benefits dispersed from its organization to the close of 1913 amounted to \$10,797,549, and the disbursements for the fiscal year 1913 amounted to \$1,442,821.

**EAGLE VULTURE.** A vulturine sea eagle (*Gypohierax angolensis*), placed by some ornithologists between the eagles and kites and by others nearer the true vultures. It is a bird of prey of the West African coast region from Senegambia to Angola and also of a limited district near Zanzibar. It resembles a vulture



in appearance, especially in the shape of the head, beak, and the naked space about the eye, but in habits is essentially a fish-eating sea eagle. (See EAGLE.) It haunts the mangrove swamps of the estuaries, but retires to the forests farther up the streams for breeding purposes. It is 2 feet in length and beautiful, being snowy white, with black wings and tail.

**EAGLEWOOD.** See ALOES WOOD; CALAM-BUCO.

**EAGRE.** See BORE.

**EAKINS, THOMAS** (1844- ). An American figure and portrait painter and sculptor. He was born in Philadelphia and studied at the Pennsylvania Academy and afterward at the Ecole des Beaux-Arts under Gérôme, also studying sculpture with Dumont. He was for years professor of painting in the Pennsylvania Academy, and he became a member of the National Academy of Design. He excels especially in draftsmanship, but in his forceful realism he often neglects pictorial qualities. In his portraits the personality of the sitter is finely rendered, but the backgrounds are cold and thin. Among the best are those of Louis Kenton, Cardinal Martinelli, Carroll Beckwith (1905), Dr. Gilbert L. Parker (1910), and P. Hayes Agnew (1913). His masterpiece is the "Clinic of Professor Gross" (Jefferson Medical College, Philadelphia), which excels from the realistic as well as from the pictorial point of view. Other good examples of his work are: "Chess Players" (Metropolitan Museum, New York); "The Cello Player" (Pennsylvania Academy of Fine Arts); "The Clinic of Professor Agnew" (University of Pennsylvania); "The Crucifixion" (Overbrook Seminary); "The Mother" (1910); "A Bohemian" (1913). He modeled the horses on the Brooklyn Soldiers and Sailors Monument and two reliefs on the Trenton Battle Monument.

**EALDRED.** See ALDRED.

**EALING, ē'ling.** A town of Middlesex, England, about 9 miles west of St. Paul's Cathedral, London (Map: London, E 5). Charles Dibdin the popular song writer, Henry Fielding the novelist, and Lady Bryon were long residents of Ealing, and it is the birthplace of Huxley. The town maintains a fine town hall, two public libraries, public baths, an art school, a hospital, an electric-lighting plant, and about 150 acres of park land. The population increased from less than 4000 in 1851 to 33,031 in 1901 (when it was incorporated) and 61,235 in 1911.

**EAMES, ēmz, CHARLES** (1812-67). An American lawyer and journalist, born at New Braintree, Mass., and educated at Harvard. In 1845 he was appointed to the Navy Department at Washington, where he soon afterward became associate editor of the *Washington Union*. He was sent by President Polk as special commissioner to negotiate a treaty with the Sandwich Islands. He was Minister to Venezuela during the administration of President Pierce. During his later years he ranked as an authority in admiralty and international law.

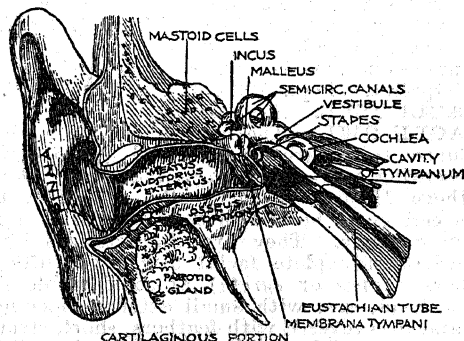
**EAMES, āmz, EMMA** (1867- ). An American soprano, born in Shanghai, China. She was brought to Maine at five and a year later began her piano studies in Boston. Her mother, who was an accomplished amateur singer, took care of her promising voice and later secured Madame Piccioto and Clara Munger as her teachers. From 1886 till 1889

she was a pupil of Marchesi, whose intimacy with Gounod secured her an engagement at the Grand Opéra to replace Patti as Juliet in Gounod's opera. She made an instantaneous success and during the two years in Paris sang also Marguerite and created Colombe in Saint-Saëns's *Ascanio* and the title part in *Zaire* by De la Nux. In 1891 she sang in London. There she married Julian Story, the portrait painter. In November of the same year she appeared at the Metropolitan Opera House in New York, and thereafter she appeared frequently in New York, London, Madrid, and Monte Carlo. Her repertoire includes rôles in French, Italian, German, and English. In 1907 she separated from Mr. Story and in 1911 was married to the baritone Emilio de Gogorza.

**EAMES, ēmz, WILBERFORCE** (1855- ). An American librarian and bibliographer, born at Newark, N. J. In 1885 he became an assistant at the Lenox Library, New York City, and in 1893 librarian. Subsequent to the consolidation, in 1893, of the Lenox Library with the Astor and Tilden trust foundations, to constitute the New York Public Library, he was known as "Lenox librarian." He edited, among other works, a comparative arrangement (1882) of the King James and revised versions of the New Testament; vols. xv-xx (1885-92) of Sabin's *Dictionary of Books Relating to America*; a comparative edition of four Latin texts (with new Eng. trans., 1892; rev. ed., 1893) of Columbus' *Letter to Sanchez on the Discovery of America*; John Eliot's *Logick Primer*, 1672 (1904); *Humble Request of Gov. Winthrop and the Company*, 1630 (1905); and he prepared *Early New England Catechisms: A Bibliography* (1898).

**EAMES, WILLIAM S.** (1857- ). An American architect, born at Clinton, Mich., and educated at Washington University, at the Ecole des Beaux-Arts, Paris, and at Rome. After 1862 he was a practicing architect at St. Louis, Mo., where he was also deputy commissioner of public buildings in 1881-83. He was the United States representative at the International Congress held at Madrid, Spain, in 1904, and was president of the American Institute of Architects in 1904-05.

**EAR** (AS. *ēare*, Ger. *Ohr*, Goth. *ausō*, OChurch Slav. *ucho*, Lith. *ausis*, Lat. *auris*, Gk. *oūs*, *ous*,



**FIG. 1. THE ORGAN OF HEARING (RIGHT) FROM IN FRONT.** The organ of hearing as it exists in man and the mammalia. It is composed of three parts: the external ear; the middle ear, or tympanum; and the internal ear, or labyrinth.

**The External Ear.** This consists of two portions: the auricle, or pinna (the part popularly recognized as the ear); and the auditory canal, or external auditory meatus. The auricle, on its outer or more exposed surface, presents various eminences and depressions resulting from the form of its cartilaginous framework. The rim, called the helix, incloses a narrow groove—the fossa of the helix—of which the inner boundary is a longitudinal ridge, parallel to the helix and known as the antihelix; usually the antihelix is divided above into two ridges which inclose a shallow depression termed the fossa of the antihelix. The large central hollow containing in its bottom the opening of the auditory canal is called the concha. In front of the external auditory meatus there is a pointed process directed backward and known as the tragus; corresponding to this is the similar process behind the meatus and pointing forward, termed the antitragus. The low-

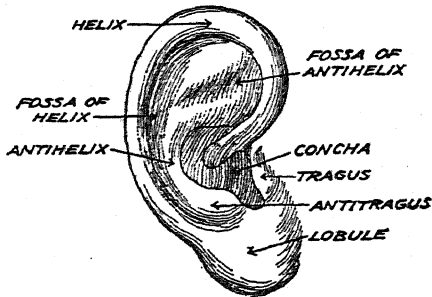


FIG. 2. THE AURICLE, OR PINNA.

est and pendulous portion of the auricle is called the lobule.

The intrinsic muscles of the auricle are, in man, functionless. Besides these, there are three extrinsic muscles, passing from the adjacent portions of the scalp to the ear; they are the *attollens aurem*, *attrahens aurem*, and *retrahens aurem*; they are rudimentary in man, though occasional individuals are able to contract them and thus perform perceptible movements of the ear at will.

The auditory canal is slightly arched and passes inward and a little forward from the concha to the tympanum; it is about  $1\frac{1}{4}$  inches long; at its outer end there are a number of ceruminous glands, which furnish an adhesive, yellow, and bitter substance, the ear wax (see CERUMEN), which serves to protect the ear from insects, dust particles, etc. The canal is partly cartilaginous and partly osseous; the osseous portion consisting in the fœtus of a bony ring, across which the drum membrane is stretched, and in many animals remaining persistently as a separate bone. The entire canal, as well as the outer surface of the drum membrane, is lined with skin.

**The Middle Ear.** This is a small, irregular cavity in the temporal bone, lined with a mucous membrane, the epithelium of which is ciliated like that of the Eustachian tube and pharynx, with which it is continuous. It contains three ossicles—the malleus (hammer), incus (anvil), and stapes (stirrup)—joined by ligaments to form a small chain attached to its outer end, by the handle of the malleus, to the drum membrane, and at its inner end, by the base of the stapes, to the membrane

covering the *fenestra ovalis*. The muscles of the middle ear are the *tensor tympani* and the *stapedius*. The former arises from the under-surface of the petrous portion of the temporal

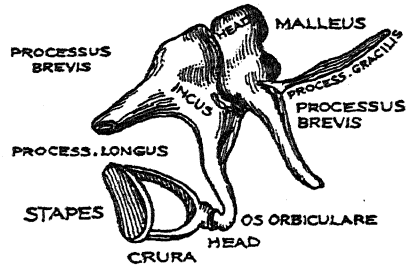


FIG. 3. SMALL BONES OF THE EAR.

bone and is inserted into the handle of the malleus. The latter takes its origin from the hollow conical eminence, termed the pyramid, which lies behind the *fenestra ovalis* and is inserted into the neck of the stapes; by pulling the neck backward it probably compresses the contents of the vestibule. The Eustachian tube, into which the tympanic cavity opens anteriorly, is about  $1\frac{1}{2}$  inches in length, and passes downward, forward, and inward to its opening in the pharynx. It is partly bony, but chiefly cartilaginous. It serves for the escape of mucus from the middle ear into the pharynx; also by allowing free passage of air in and out of the tympanum, it renders the pressure upon the inner surface of the drum membrane equal to the atmospheric pressure upon its outer surface. Upon the inner wall of the tympanum there are two openings: the *fenestra ovalis*, mentioned above, leading into the vestibule; and the *fenestra rotunda*, covered by a membrane, leading into the cochlea.

**The Internal Ear, or Labyrinth.** This consists of three parts: the vestibule, the cochlea, and the semicircular canals. The vestibule is a small central cavity communicating by openings in its posterior wall with the semicircular canals; anteriorly the cochlea enters it by a single opening, the beginning of the *scala vestibuli* described below. On its outer wall is the *fenestra ovalis*, and on its inner there are a num-

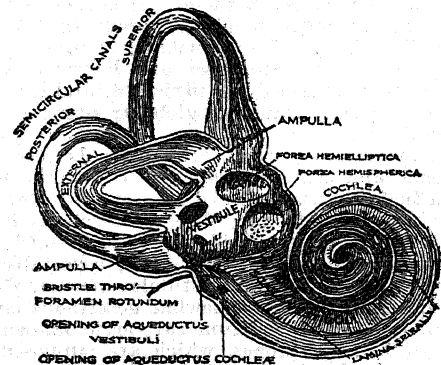


FIG. 4. THE OSSEOUS LABYRINTH, LAID OPEN AND ENLARGED

ber of minute orifices for the entrance of the filaments of the auditory nerve. The cochlea (Lat., snail shell) is situated in front of the vestibule. It is a spiral canal wound around a bony axis, termed the modiolus, which is per-

forated at its base for the entrance of the filaments of the cochlear portion of the auditory nerve. The interior of the cochlea is subdivided by an osseo membranous partition, the *lamina spiralis*, into two passages—the *scala vestibuli*,

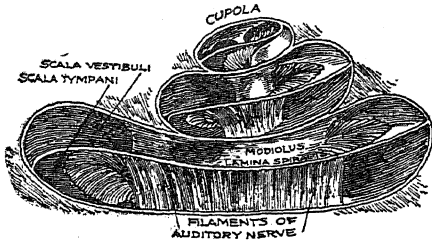


FIG. 5. THE COCHLEA, ENLARGED.

opening into the vestibule, and the *scala tympani*, the communication of which with the tympanic cavity (the *fenestra rotunda*) is covered by a membrane as described above; the two *scalæ* communicate at the apex of the cochlea by an opening called the helicotrema. Between the two *scalæ* there is a third space, termed the *scala intermedia*, which contains the terminations of the filaments of the auditory nerve in a complicated arrangement of peculiarly formed neuro-epithelial cells termed collectively the organ of Corti. (See AUDITORY NERVE.) The semicircular canals are three in number and open at both ends into the vestibule. They vary in length, and, notwithstanding their name, each is considerably more than a semicircle, the superior vertical canal being the longest. Their average diameter is about one-twentieth of an inch, the extremities of each canal exhibiting a slight dilatation called an ampulla. Each canal lies in a different plane, very nearly at right angles to the planes of the other two; hence their names of the superior vertical, the inferior vertical, and the horizontal canals. According to a later nomenclature they are named respectively the perpendicular, oblique, and external semicircular canals. We now turn to the membranous labyrinth. The membranous and osseous labyrinths have the same shape, but the former is considerably smaller than the latter, a fluid, termed the perilymph, intervening in some quantity between them. At certain points the membranous is firmly adherent to the osseous labyrinth. The vestibular portion consists of two sacs, an upper and larger one, of an oval shape, termed the utricle, and a lower and smaller one, of a more globular shape, called the sacculus.

The membranous semicircular canals resemble in form and arrangement the osseous canals which inclose them, but are only one-third of the diameter of the latter. The membranous labyrinth is filled by a fluid which is termed the endolymph; and in certain spots, especially at the terminations of the vestibular nerves, there are, suspended in the somewhat gelatinous endolymph, crystals of calcium carbonate known as otoliths, i.e., ear stones, which are supposed to intensify the impression of the sound waves upon the nerve endings.

We now proceed to consider the different functions of the various parts of the ear.

**The External Ear.** A true auricle exists only in the mammalia, and in this class it varies from little more than an irregularly shaped cartilaginous disk, with little or no motion, as in

man and the quadrumana, to an elongated, funnel-shaped ear trumpet, moveable in all directions by numerous large muscles, as in the horse, the rabbit, etc. The mode in which we see it employed in animals in which it is highly developed sufficiently indicates that its main function is to collect the sound waves that fall upon it, and to direct and concentrate them upon the drum membrane.

**The Middle Ear.** The vibrations of the tympanic membrane are transmitted through the ossicles and the membrane covering the *fenestra ovalis* to the perilymph. The pressure in the tympanic cavity is kept the same as that of the atmosphere by the Eustachian tube. Whenever the drum membrane is too tightly stretched, by increase or decrease of pressure within the middle ear, it cannot vibrate freely, and hearing is impaired. This often occurs as a result of acute and chronic inflammation of the pharynx, when the swelling of the mucous membrane closes the Eustachian tube, producing the so-called throat deafness.

**The Internal Ear.** Sound is conducted to the labyrinth either by the external and middle ear, as described above (air conduction), or through the bones of the head (bone conduction); normally air conduction is better than bone conduction. In diseases of the middle ear or in obstructions of the external auditory meatus air conduction is not so good as bone conduction. Advantage is very frequently taken of this fact in the differential diagnosis between diseases of the internal ear and those of the middle or of the external ear. To test the air conduction a vibrating tuning fork is held close to the ear; to test the bone conduction the handle of the tuning fork is brought in contact with the teeth, forehead, mastoid process, etc., in turn. As stated, it is the base of the stapes that communicates the vibrations to the perilymph; this would be impossible but for the existence of the *fenestra rotunda*, which acts as a vent for the vibrations of the perilymph and endolymph; every time the membrane of the *fenestra ovalis* bulges in, that of the *fenestra rotunda* bulges out, and vice versa. The internal ear also performs the most essential function connected with hearing: that of perception of auditory impressions by means of the cochlear and vestibular terminations of the auditory nerve. It remains for us now to consider the function of the semicircular canals. It is now a generally recognized fact that they are not connected with the sense of hearing. They have to do with the maintenance of the equilibrium of the body. The fact was established by Ewald in 1892. To maintain equilibrium in the various positions of rest and especially in locomotion, the accurate coördination of a great many muscles is necessary. The cerebellum is the organ which sends out the nerve impulses to these muscles; this action is an unconscious one, being purely reflex in character. The afferent impulses which bring about these reflexes are, besides others of secondary importance, the ones conveyed to the cerebellum from the semicircular canals. When these canals are removed in animals, or when they are diseased in man, as in Menière's disease, there are invariably profound disturbances of equilibrium, the subject being unable to stand or even to sit, without swaying or falling, to say nothing of such complicated acts as walking, jumping, etc.

The range of hearing, like that of vision, varies remarkably in different persons. Some persons

are insensible to sounds which others can readily hear. The ordinary range of human hearing includes, according to Wollaston, more than nine octaves. Technically stated, the normal ear perceives vibrations as musical notes from 16 vibrations per second to about 32,500. The sensation of sound, like that of light, frequently lasts longer than the exciting cause. We have familiar proof of this fact in the noise which remains in the ears after a long journey in a coach or railway car; and this fact was clearly demonstrated by Savart, who found, in his experiments on toothed wheels, that the removal of one tooth did not produce any interruption of the sound.

#### DISEASES

The diseases of the ear are divided into diseases of the auricle, diseases of the external auditory apparatus, diseases of the middle ear, and diseases of the mastoid process.

**Diseases of the Auricle.** Under this head are included congenital malformations of the auricle, such as deformities, appendages and supernumerary growths, wounds, injuries, cutaneous diseases, inflammatory processes attacking the cartilage, abscesses, erysipelas, and tumors.

**Diseases of the External Auditory Apparatus.** Under this head are included furuncle or boil, cellulitis, impacted wax, foreign bodies in the ear, bony growths, and wounds or other injuries of the drum membrane.

The conditions mentioned in the two foregoing divisions need no more than individual mention, either because their treatment is similar to that of similar conditions elsewhere in the body, or because their titles suggest the remedies appropriate.

**Diseases of the Middle Ear.** 1. *Tubal catarrh* is a congestive condition of the Eustachian tube, leading from the throat to the middle ear. The result of this affection is closure of the tube, with deafness and constant noises heard, with a sense of fullness in the head. Inflation of the tube is the treatment, with possibly subsequent dilatation and treatment with medicated vapors. 2. *Acute catarrhal inflammation of the middle ear* is an affection of the superficial structures that line the middle ear, with the production of seropus in such quantity that often the ear drum bulges and may even burst. Incision is necessary to prevent bursting and to secure drainage. The malady may complicate measles or catarrh of nose and throat, or may be caused by the introduction of fluid through the Eustachian tube while bathing. In young children the disease may appear suddenly at night, with a temperature of 102° to 104°, and a period of intense suffering, relieved by rupture of the drum and pouring out of a little serous discharge that stains the pillow. Rise of temperature may continue on the following day, together with deafness and noises in the ear. As a rule, the cases terminate favorably without treatment. Suppuration may occur involving the mastoid cells. The treatment is directed first to relief of pain, by using a saline cathartic and an opiate. Local bloodletting by means of the artificial leech and the application of dry heat may abort an attack. If these measures fail to abort it, incision of the drum must be made, and the ear must be syringed and dressed antiseptically. 3. *Chronic catarrhal inflammation of the middle ear* is either of the hypertrophic or of the hyperplastic variety. In the

hypertrophic variety there is a swelling of the lining membrane of the tympanum due at first to chronic venous congestion, after which occurs hypertrophy of the elements of the tissue lining the cavity. Fibrous layers appear, and calcareous deposits may ensue. The drum membrane, the ossicles, the ligaments, and the walls of the Eustachian tubes share these changes. Exudate of serum or seromucus collects in the cavity. Among the causes for this condition are repeated attacks of acute rhinitis, the presence of adenoid tissue in the vault of the pharynx, impairment of the general health, and the abuse of alcohol. The results are impaired hearing, whistling or buzzing or crackling noises in the ear, and occasional neuralgic pains, especially upon swallowing. Entire recovery can never be promised in these cases, but treatment by the aural surgeon, of a technical and intricate nature, may cause vast improvement and avert total deafness. Chronic hyperplastic otitis media may develop from the hypertrophic form and is characterized by an appearance of firm and fibrous new tissue, diminished secretion, thickening of the walls of the supplying blood vessels, with a resulting sclerosis. The symptoms resemble closely those of the hypertrophic variety, with the addition of giddiness in the early stages and a marked neurasthenic or even melancholic condition, due partly to the temperamental state which invited the attack, partly to the fatigue of the higher cerebral centres resulting from repeated efforts to hear conversation. The prognosis for recovery is very grave, and the disease is less amenable to treatment than any other aural trouble. Treatment is directed by the aural surgeon towards the relief of the rigidity of the ossicular chain, by inflation, exercise of the tubal muscles, the use of the Eustachian bougie, and of the myringotome and several operative procedures. Hydrobromic acid or pilocarpine may be desirable for internal use. 4. *Acute purulent otitis media* most frequently follows an infectious disease, such as scarlatina, la grippe, smallpox, cerebrospinal meningitis, pneumonia, etc. Pus forms behind the drum head and may dissect its way into the neighboring soft parts or may invade the mastoid. The prominent symptoms are very severe pain deep within the ear, a temperature of 101° or 103°, severe general headache, and great depression. Invasion of a sinus may ensue, and pyæmia may result, accompanied by a higher temperature, delirium, convulsions, and paralysis. Immediate and vigorous operative measures employed by an aural surgeon constitute the only treatment. 5. *Chronic purulent otitis media* occurs as a sequel to the acute form and, like it, is due to tissue necrosis. Discharge from the ear is the only prominent symptom, and one which should always suggest the necessity for competent medical advice. 6. *Otitis media purulenta residua* is a term applied to a class of cases in which a former purulent inflammation has resulted in a permanent destruction of some of the tympanic structures. It may be either acute or chronic. The aural surgeon alone can differentiate this condition and advise regarding the antiseptic irrigation necessary or the removal of dead bone which may have become imperative. See OTITIS MEDIA.

**Diseases of the Mastoid Process.** Inflammation of this process may result from extension of a similar process from the middle ear. A chronic suppurative otitis media is the most fre-

quent cause of acute mastoiditis. It may follow exposure to cold, a traumatism, or general tubercular or syphilitic infection. A destruction of the osseous tissue results. The most prominent symptom is intense pain over the mastoid process especially at night, a temperature of 99.5° to 101.5°, difficulty in moving the head from side to side, and tenderness upon deep pressure over the tip of the mastoid. But slight constitutional disturbance is present. Involvement of a venous sinus with the production of an infectious thrombus may occur; emboli may develop and lodge in various viscera; diffuse meningitis may complicate the disease, with resulting paralysis; or the rarer cerebral abscess may follow. The diagnosis of mastoid disease is a matter of difficulty for any but an expert observer, although two signs are very reliable. These are local tenderness upon deep pressure over the mastoid region, and a depression or sagging of the superoposterior wall of the canal, close to the tympanic ring. Besides these signs, a localized tumefaction of the posterosuperior canal wall (if it occur) is very indicative of mastoid involvement. Many other symptoms present themselves, similar to those enumerated in the consideration of other diseases afflicting the ear. The prognosis is always grave. The treatment consists in rest in bed, fluid diet, catharsis, extensive incision of the drum membrane, if seen early, together with irrigation of the canal and the employment of the Leiter coil, by which cold is applied to the whole mastoid portion of the temporal bone. Drugs are given to relieve pain. After 48 hours have passed without amelioration, operative interference is necessary. In such a case the surgeon makes an incision through the soft parts back of the ear and with mallet and chisel makes an opening through the cortex into the mastoid cells, whence all softened bone tissue is removed with the sharp spoon.

Consult: *Book of Anatomy* (New York, . . . , *Kirk's Handbook of Physiology* (Philadelphia, 1907); Dench, *Diseases of the Ear* (New York, 1909); Bacon, *Manual of Otology* (ib., 1909); article "Ear," in *Reference Handbook of the Medical Sciences* (ib., 1913); Whiting, *The Modern Mastoid Operation* (ib., 1911). See AUDITION; ACOUSTICS, and the authorities there referred to.

**EAR, COMPARATIVE ANATOMY OF THE.** The question of the hearing powers of animals is still a subject of dispute, and we cannot say positively whether the lower animals are conscious of sound waves, as such, or not. But if we bear in mind that the human ear is not merely an organ of hearing, but is also the means by which we determine our position (in other words a positional organ), then we are justified in saying that many invertebrates have ears, even though we deny them the sense of hearing.

**Positional and Chordotonal Organs.** Positional organs as found in the simplest conditions are minute balls of mineral matter suspended in a flexible club-shaped body and are known as sense clubs. They are formed on the margin of the bell in many medusae. In some cases they are surrounded by long hairs against which they strike when they move. In a still more advanced condition they are situated in a depression, and the surrounding tissue grows over and about them, so as to inclose them in a cavity. It is but a step from such a condition to the form of positional organs, called otocyst, which occurs

in many invertebrates. An otocyst is a spherical cavity lined with cilia and containing one or more balls of mineral matter called otoliths. The otocyst is specially and fully innervated, the stimuli coming from the movements of the otolith against the cilia, accompanying changes in the position of the body. There is no evidence to show that such organs are capable of detecting sound waves. Otocysts occur in medusae, many kinds of worms, numerous mollusks, a few echinoderms, and the higher crustacea. In the latter the vesicles often remain open, and the otoliths are grains of sand; the vesicles are lined with delicate hairs, some of which are actually attached to the otoliths. Insects have no otocysts, but in their place we find remarkable structures known as chordotonal organs, which lie in the integument of various parts of the body. They are largest and most highly developed in grasshoppers, locusts, and crickets, and two or four of them are very large and are known as the tympana. They lie on the sides of the abdomen or on the tibiae of the forelegs. Chordotonal organs seem to be particularly adapted for the detection of sound waves, but how they can serve as positional organs is not clear.

**Primitive Auditory Organs.** Turning now to vertebrates, we find a general agreement with the structure of the human ear, even in fishes, although in details and proportions there is much variety. In the cyclostomes it is probable that there is no real sense of hearing, for the semi-circular canals are the only well-developed parts of the ear, and these are believed to be specially concerned with the positional function. Whether other fishes actually hear sounds is still a disputed question. The cochlea is, in fishes, simply a small knoblike appendage of the sacculus and shows none of the complexity of the mammalian cochlea. In most fishes large otoliths are present in the labyrinth, and in many fishes there is direct connection between the ear and the air bladder by means of a chain of small bones. Certain experiments (1902) by Dr. G. H. Parker of Harvard apparently demonstrate the actual recognition of sounds by some fishes, and that this recognition is dependent upon the uninjured condition of the ears and auditory nerves. In Amphibia a certain sensory zone near the base of the lagena represents the origin of the cochlea, and this part of the ear increases in complexity as we pass upward through reptiles to birds and mammals. Even in crocodiles and birds, however, there is no organ of Corti in the cochlea, and there is a single bony columella instead of the three auditory ossicles of mammals. In many respects the ears of monotremes are noticeably like those of the Crocodilia. Fishes, amphibians, and most reptiles have no outer ear, and the pinna is only found in certain mammals. The external ear is first noticeable in certain lizards, where it is represented by a simple fold of skin. In the mammals the lagena is greatly reduced, and the cochlea is highly developed, showing two to five spirals.

**Bibliography.** Lang, *Comparative Anatomy* (New York, 1896); Wiedersheim, *Comparative Anatomy of Vertebrates* (ib., 1897; and new German ed., Jena, 1902); Retzius, *Das Gehörorgan der Wirbelthiere* (Stockholm, 1881, 1884); Gegenbaur, *Vergleichende Anatomie der Wirbelthiere* (Leipzig, 1898); Bárány, *Physiology and Pathology of the Ear* (New York, 1910); Bean, *Racial Anatomy of the Philippine Islanders*

... with a Classification of Human Ears (Philadelphia, 1910); Meyer, *Introduction to the Mechanics of the Inner Ear* (Columbia, Mo., 1907).

**EARCOCKLES**, PURPLES, or PEPPERCORN. A disease in wheat caused by a nematode worm (*Tylenchus tritici*). This worm is yellowish white, slender, tapering towards the tail, and more suddenly attenuated to a point at the head. It finds its way to the flowers; the infected grains become dark green, then black, rounded like small peppercorns, and furrowed on the surface; the glumes spread open, and the awns become twisted; the grains are filled with a white cottony substance which consists of myriads of the nematodes. The disease has recently been reported in the United States.

**EAR FUNGI**. An order (Auriculariales) of Basidiomycetes characterized by spore-bearing structures which resemble ears. These earlike growths are found on bark, board fences, etc., a very common form being seen on old stems of elder. When moist, the ears are gelatinous and brightly colored. When dry, they become hard, gray, wrinkled, and hairy.

**EAR OF DIONYSIUS**. See DIONYSIUS, EAR OF.

**EARL** (AS. *eorl*, Icel. *earl*, Dan. *jarl*, earl, OS., OHG. *erl*, man, warrior). A title of the British nobility, third in rank under the princes of the blood royal, next to a marquis, and above a viscount. In Anglo-Saxon times the word denoted the primitive noble by birth of the first settlement, the *nobilis* of the Old Germans, as distinguished from the *ceorl*, or common freeman. From this class the magistrates, priests, and kings were chosen. But with the development of the royal power in England, and consequently of thanehood, a nobility by service, the *eorl* sank one degree in the social scale and was merged into the class of thanes.

In the later Saxon period the word *eorl* changed its significance, being used for *ealdorman*. This was an administrative officer, the chief magistrate of a shire or cluster of shires. He was originally a viceroy, the subjected king of a conquered district or one of his family, or a near kinsman of the overking (*atheling*). The office might be hereditary, but it tended to become appointive. The ealdorman was appointed in the general assembly of the nation, and, even where the office was hereditary, the consent of king and nation was necessary. He sat with the bishop in the folkmoot of the shire, declaring the secular law, as the bishop did the spiritual. He was head of the military levy of the shire and exercised the royal police jurisdiction.

To maintain his dignity, he received a third of the profits of the administration of justice in the shire. After the Danish incursions the office became an upper governorship, and the incumbent was frequently changed. The Danish word *jarl*, English *eorl*, was applied to it. Canute divided England into four earldoms, and there were five under Edward the Confessor.

William the Conqueror, while retaining all the dignity of the office, reduced its power by making it hereditary and giving its judicial functions to the sheriff or vicecomes (vice earl), his own appointee. The great earldoms were gradually broken up, and the holdings of the earls scattered through different shires. William bestowed the title sparingly, but under his successors, especially during the civil war of Stephen and Matilda, it was lavishly given.

This ceased with Henry II. The title corresponded with the French *comte*, an earl's wife being always called countess. The office of earl remained essentially a county office, usually taking its name from the shire. The third penny of the pleas was still granted to show this connection and does not disappear until the thirteenth century, when its place is taken by a fixed sum called creation money. The earl was the highest in rank of the nobility until Edward III created a duke in 1357 and Richard II a marquis in 1385. He had a hereditary right to a seat in Parliament.

The title was originally conferred by investiture, the King himself girding on the sword of the county (signifying the temporal authority in the county). Edward III, wishing to avoid the hatred caused by his father's investiture of favorites, first began the custom of creating earls in Parliament, and also that of investiture by charter or letters patent. Now only the last-named method prevails. The dignity of an earl is not partible, and, although it may descend through a woman, it reverts to the crown in case of coheirs. In the fourteenth century limitations to heirs male of the body became the rule.

The number of earls varies in the different periods of English history. In the Middle Ages there were very few earls, but the Stuarts greatly increased the number, especially James I, who sold the dignity for £20,000. Now there are over 200 earls in the United Kingdom, and the territorial nature of the dignity has so far disappeared that they even take the titles from their names, as did Earl Grey and Earl Russell. The earl's coronet is a gold circlet, with light spikes, on the tips of which are pearls alternating with strawberry leaves. The eldest son takes the courtesy title of the family, usually of viscount, younger sons are "The Honorable," and all daughters are "ladies," the title being prefixed to the given name for life, unless marriage brings a title.

**Bibliography**. For the earliest period the sources are the Anglo-Saxon laws, in the editions of R. Schmid (Leipzig, 1832), B. Thorpe (Record Commission, 1840), and, best of all, F. Liebermann (Halle, 1898 et seq.). Compare Schmid's *Glossary*, sub "Eorl," and Liebermann's *Commentary*, vol. ii. Among modern authors are J. M. Kemble, *Saxons in England* (London, 1876), and K. Mauer, *Kritische Ueberschau der deutschen Gesetzgebung* (Munich, 1853-56). The sources for the period since the Conquest are best found in the letters patent and other material published in *Reports from the Lords' Commission on the Dignity of a Peer of the Realm* (London, 1820-29), especially in the third report. Based on this is Sir Harris Nicholas, *Historic Peerages of England* (continued by W. Courthope, ib., 1857), sub "Earl." Good brief modern accounts for the entire period are those of William Stubbs, *Constitutional History* (Oxford, 1894), vol. i, pp. 125-126, 168-169, 176-178; R. Gneist, *History of the English Constitution*, trans. by P. A. Ashworth, vol. i, pp. 138-141; see p. 140, note, for the older literature (New York, 1886). R. Selden, *Titles of Honor* (London, 1614), is still useful.

**EARLE**, ALICE MORSE (1853-1911). An American writer on Colonial history. She was born in Worcester, Mass., and graduated at the Worcester High School. In 1874 she was married to Henry Earle. She wrote voluminously on the social and domestic history of Colonial



New England and New York and in her various books presents a mass of quaint and interesting information. Her publications include: *The Sabbath in Puritan New England* (1891); *China Collecting in America* (1892); *Customs and Fashions in Old New England* (1893); *Life of Margaret Winthrop* (1894); *Colonial Dames and Goodwives* (1895); *Costume of Colonial Times* (1895); *Colonial Days in Old New York* (1896); *Curious Punishments of Bygone Days* (1897); *Home Life in Colonial Days* (1898); *Child Life in Colonial Days* (1899); *Stage Coach and Tavern Days* (1900); *Old Time Gardens* (1901); *Sun-Dials and Roses of Yesterday* (1902); *Two Centuries of Costume in America* (2 vols., 1903).

**EARLE, FRANKLIN SUMNER** (1856- ). An American botanist and agriculturist, born at Dwight, Ill., and educated at the University of Illinois and at the Alabama Polytechnic Institute. Between 1894 and 1896 he served in several experiment stations and as assistant pathologist in charge of the mycological herbarium of the United States Department of Agriculture, and he was professor of biology at the Alabama Polytechnic Institute from 1896 to 1901. As assistant curator in charge of the mycological collection of the New York Botanical Garden he visited Jamaica and Cuba in 1903, and in the same year he conducted researches in Porto Rico for the government. He was director of the Estación Central Agronómica of Cuba in 1904-06 and in 1908 became consulting agriculturist to the Cuban-American Sugar Company. In 1906-07 he was president of the Botanical Society of America. He is author of *Southern Agriculture* (1908).

**EARLE, JOHN** (1824-1903). An English philologist and divine. He was born at Elston and was educated at Oxford, where he was professor of Anglo-Saxon from 1849 to 1854 and again after 1876. He was appointed rector of Swanswick in 1857, prebendary of Wanstrow in 1871, and became professor of Anglo-Saxon in Oxford University in 1876. His principal publications are: *Gloucester Fragments* (1861); *The Philology of the English Tongue* (5th ed., 1892); *A Book for the Beginner in Anglo-Saxon* (3d ed., 1884); *Anglo-Saxon Literature* (1884); *Hand-Book to the Land-Characters and other Saxon Documents* (Oxford, 1888); *The Deeds of Beowulf* (1892); *Two of the Saxon Chronicles Parallel, with Supplementary Extracts from the Others* (Oxford, 1865; rev. ed., with introduction and notes, by Plummer, ib., 2 vols., 1892-99); *Anglo-Saxon: Its Elements, History, and Usage* (1890); *The Psalter of 1539: A Landmark in English Literature* (1894); *A Simple Grammar of English Now in Use* (1898); *The Alfred Jewel* (1901).

**EARLE, MORTIMER LAMSON** (1864-1905). An American classical scholar. He was born in New York and received the A.B. from Columbia College in 1886 and his doctorate in 1889. From 1889 to 1895 he was instructor in Greek in Barnard College; he was then appointed associate professor of Greek and Latin in Bryn Mawr; from 1898 to 1900 he was lecturer in Greek in Columbia University; and in 1900 he became professor of classical philology in Barnard College, New York. His literary work included the editing of Euripides' *Alceste* (1895); Sophocles' *Oedipus Tyrannus* (1900); and Euripides' *Medea* (1904). His numerous contributions to learned periodicals were collected in *The Classi-*

*cal Papers of Mortimer Lamson Earle, with a Memoir* (New York, 1912). He was a contributor to the first edition of the NEW INTERNATIONAL ENCYCLOPÆDIA.

**EARLE, PLINY** (1809-92). An American psychiatrist, born at Leicester, Mass. He received his medical education at the University of Pennsylvania, graduating in 1837; was a resident physician at Friends' Asylum for the Insane, Frankford, Pa., from 1840 to 1844; superintendent of Bloomingdale Asylum, New York City, from 1844 to 1853; visiting physician to the New York City Asylum, Blackwell's Island, from 1853 to 1864; professor of materia medica and psychology in the Berkshire Medical Institution at Pittsfield, Mass., from 1863 to 1864; and superintendent of the State Lunatic Hospital, Northampton, Mass., from 1864 to 1885. He published: *A Visit to Thirteen Asylums for the Insane in Europe* (1841); *Blood-letting in Mental Disorders* (1854); *Psychologic Medicine: Its Importance as a Part of the Medical Curriculum* (1867); *The Psychopathic Hospital of the Future* (1867); *Prospective Provision for the Insane* (1868); *Curability of Insanity* (1877).

**EARLE, THOMAS** (1796-1849). An American lawyer. He was born at Leicester, Mass., but when young settled in Philadelphia. He was a member of the Philadelphia Constitutional Convention of 1837. By advocating the extension of the right of suffrage to colored men he antagonized many members of the Democratic party, and in 1840 the Liberty party made him their candidate for Vice President. Subsequently he left politics for literary work and published: *Essay on the Penal Law; Essay on the Right of States to Alter and Annul their Charters; Treatise on Railroads and Internal Communications* (1830); *Life of Benjamin Lundy* (1874).

**EARLE, WILLIAM** (1833-85). An English soldier. He was born in Liverpool, was educated at Winchester, entered the army in 1851, and served with great gallantry in the Crimean War. He became colonel in 1868 and from 1872 to 1876 acted as military secretary to Lord Northbrook, Viceroy of India. He was commander of the garrison of Alexandria during Lord Wolseley's campaign against Arabi Pasha and in 1884 was division commander in the expedition dispatched to the aid of General Gordon at Khartum. He was killed while leading his detachment against Arab intrenchments at Kirbekan (Feb. 10, 1885).

**EARLHAM COLLEGE.** An institution of higher learning founded in 1859 by Orthodox Friends at Richmond, Ind. It succeeded a school of advanced grade which was opened for students in 1847. The college is coeducational. It is located on a tract of 120 acres, adjoining the western limits of the city of Richmond. The campus has an area of 40 acres, is shaded by native forest trees, and is tastefully laid out with walks and drives. There are eight buildings on the campus: Lindley Hall, Parry Hall, Earlham Hall, Edwin S. Bundy dormitory, the library, the astronomical observatory, the gymnasium, and the central heating and lighting plant. The college grants only two bachelor's degrees, B.A. and B.S. The degree of M.A. is granted on the basis of liberal culture rather than specializing. The endowment amounts to about \$750,000, and the value of the college grounds and buildings to about \$375,000. The annual income is about \$140,000. The total number of students



in the collegiate year 1913-14 was 413, and the instructors numbered 31. The library contains about 20,000 volumes. The president of the College in 1914 was Robert Lincoln Kelly, Ph.M., LL.D.

**EARLINGTON.** A city in Hopkins Co., Ky., 54 miles south of Evansville, Ind., on the Louisville and Nashville Railroad (Map: Kentucky, C 5). It is in the centre of a coal-mining region and has extensive manufactures of coke. Under a charter of 1897 its government is vested in a mayor, elected for a term of four years, and a unicameral council of six members. There are two public libraries. Pop., 1900, 3012; 1910, 3931.

**EARL MARSHAL.** See MARSHAL.

**EARLOM, er'lom, RICHARD** (1743-1822). An English mezzotint engraver. He was born in London and studied there under Cipriani. In mezzotint he made some innovations in the use of the point, which gave delicacy to his method, and established his fame by fruit and flower pieces after J. van Huysum. He engraved also after Reynolds, Beechey, Hogarth, and the Dutch and Italian masters. His most important work was the reproduction of 300 drawings of Claude Lorrain in the Duke of Devonshire's collection, known as the *Liber Veritatis* (1777-1819).

**EARLY, JOHN** (1786-1873). An American bishop of the Methodist Episcopal Church South, born in Bedford Co., Va. He entered the Methodist ministry in 1807. It is said that his first religious work was among the slaves of Thomas Jefferson. He was one of the founders of Randolph Macon College and was for years president of its board of trustees. In 1846 he was elected book agent of the Methodist Episcopal Church South and in 1854 one of its bishops.

**EARLY, JUBAL ANDERSON** (1816-94). An American soldier, prominent on the Confederate side in the Civil War. He was born in Franklin Co., Va., graduated at West Point in 1837, served in the Seminole, or Florida, War of 1837-38, and resigned from the army to take up the practice of the law at Rocky Mount, Va., in July, 1838. In 1841-42 he was a member of the Virginia House of Delegates, and from 1842 to 1847 and again from 1848 to 1852 he held the position of commonwealth attorney. During the Mexican War he was major of a regiment of Virginia volunteers from January, 1847, to August, 1848. On the approach of the Civil War he was strongly in favor of the maintenance of the Union, and in the Virginia Convention of 1861 he strenuously opposed the adoption of the ordinance of secession; but, the ordinance having passed, he threw in his lot with his State and entered the Confederate army as colonel of the Twenty-fourth Regiment of Virginia Infantry. He commanded a brigade at the first battle of Bull Run, rendering effective service to his side at a critical part of the battle: was promoted soon afterward to be brigadier general; took a prominent part in the battle of Williamsburg, May 5, 1862, where he was seriously wounded; and distinguished himself in the second battle of Bull Run and in the battle of Antietam. At Fredericksburg, on Dec. 13, 1862, he commanded a division, and during the battle of Chancellorsville he commanded the right wing of General Lee's army, stationed at Fredericksburg, which was opposed to the Federal General Sedgwick. In January, 1863, he was promoted major general. He commanded a division of Lee's army at Get-

tyburg. Detached from that army in June, 1864, to operate against the Federal forces in the Shenandoah valley, Early, who had been commissioned lieutenant general May 31, repelled an attack of Hunter at Lynchburg on the 18th and forced that officer to the upper Potomac. The valley thus being left open, he advanced to Winchester, drove the Federal General Sigel to Maryland Heights, crossed the Potomac on July 6, levied \$20,000 on Hagerstown and \$200,000 on Frederick City, and on the 9th defeated Gen. Lew Wallace at Monocacy Junction. On the 11th he threatened the city of Washington, which was in a state of consternation, and which by a prompt attack he would probably have taken; but, a strong Federal reinforcement having arrived, he withdrew without serious molestation and retired up the Shenandoah valley. Towards the latter part of the month he again drove across the Potomac the Federal forces opposed to him, and in addition sent a cavalry detachment into Pennsylvania under McCausland, who occupied Chambersburg on July 30 and, in default of a ransom of \$100,000 in gold, burned the town in accordance with Early's orders. From August to November he contended against Sheridan, then in command of the Federal army of the Shenandoah, for the possession of the Shenandoah valley. He was finally defeated by superior numbers at Opequon Creek, near Winchester (September 19), and Fisher's Hill (September 22). On October 19 he surprised the Federals at Cedar Creek, but the timely arrival of Sheridan turned the fortunes of the day, Early's forces being routed. In March, 1865, Early was defeated by Custer at Waynesborough and was removed from command by Lee. By many military critics he is placed below only Lee and Jackson in the list of Confederate generals. After the war he lived for a short time in Canada, but in 1867 returned to Virginia, practiced law there for a time, then was associated with General Beauregard in the management of the Louisiana Lottery at New Orleans, and passed his last years in Virginia. He steadfastly refused until his death to take the oath of allegiance to the United States. General Early was for a time president of the Southern Historical Society. Besides several addresses on military subjects, he published *A Memoir of the Last Year of the War for Independence, in the Confederate States of America* (1867). For an account of General Early's operations in the Shenandoah valley, consult: Johnson and Buel (ed.), *Battles and Leaders of the Civil War*, vol. iv (4 vols., New York, 1887); Pond, *The Shenandoah Valley in 1864* (ib., 1883), in the "Campaigns of the Civil War Series"; and articles by Long and Daniel in vol. xviii and vol. xxii, respectively, of the *Southern Historical Society Papers* (Richmond, 1890, 1894).

**EARLY ENGLISH.** The term generally applied to the earliest phase of Gothic architecture (q.v.) in Great Britain. It is really a transitional style, through which English church architecture passed in its development from the Anglo-Norman into the more truly Gothic style known as the Decorated (q.v.). Broadly speaking it covered the century from 1175 to 1275. Its chief characteristics are the tall narrow pointed windows (whence it is often called the Lancet style), used singly or in groups, the pointed arch, clustered shaft, and ribbed groined vault, together with certain

characteristic decorative details, such as the exquisitely carved foliated capitals with round abaci, and the fine crowded moldings of the pier arches. Structurally the buildings of this period show an imperfect appropriation of the Gothic principle of isolated supports and concentrated thrusts. The wall was still the basis of design, the masonry massive, the windows relatively small, and the interior division into bays not strongly expressed. Towards the end of the period, however, the windows were increased in size, the walls made thinner, the piers lighter; geometric bar tracery (see TRACERY) began to replace the plate tracery which had early come into use in place of mere groupings of lancet windows; and the Gothic principle of vaulting on a framework of ribs was carried farther than in France by the multiplication of the ribs (tiercerons). The chapterhouses of Lincoln, Salisbury, Westminster Abbey, and Wells, of the second half of the thirteenth century, and the cloisters of Salisbury, are completely Gothic in construction as well as style. But, owing in part to the lowness of the vaulting, in part to English conservatism, the flying arch and buttress were never conspicuous in this period, the resistance to thrust being effected by arches under the side-aisle roofs in most cases.

The earliest example of the style is the choir of Canterbury (1175-84), followed by the choir, transepts, and later the nave of Lincoln (1192-1250). Lincoln is almost purely English in every feature except the six-part vault of the east transept, which is French in design, as is the Canterbury choir. The nave of Wells (1190-1225) is Gothic in details, but Norman in conception. The most complete exemplar of the style is Salisbury Cathedral (1220-58). Westminster Abbey was begun in 1245, but the nave was not completed till the fifteenth century; it shows a French Gothic conception carried out with English details. Other examples are the choirs of Worcester, Chester, and Gloucester cathedrals, the transepts of York, parts of the choir of Ely and Winchester, and the "Nine Altars" of Durham. Consult: Rickman, *An Attempt to Discriminate the Styles of English Architecture* (London, 1849); Moore, *Development of Gothic Architecture* (New York, 1899) and *Medieval Church Architecture in England* (ib., 1912); Prior, *History of Gothic Architecture in England* (London, 1900); Bond, *Gothic Architecture in England* (ib., 1907) and *An Introduction to English Church Architecture* (ib., 1913).

**EARLY ENGLISH TEXT SOCIETY.** A society founded by F. J. Furnivall (q.v.) in 1864 for the publication of Old and Middle English manuscripts. It has issued every year original-series texts (devoted to first editions of manuscripts), and since 1867 extra-series texts (mainly reprints of old books printed by Caxton and other early publishers). The society has as members some of the best English scholars in England, the United States, and Germany. Its publications, numbering more than 200, are indispensable to the student of early English literature.

**EARMARK.** A method of identification of cattle in the West used in addition to branding (q.v.). It consisted in a slitting, cropping, or notching of one or both ears and was usually made when the calf was being branded. Each cattleman had his distinctive earmark as well

as his brand, and the great value of the former lay in the fact that when the half-wild range cattle saw a man they invariably turned and faced him so that the projecting ears showed the earmark plainly. Earmarks were too easily altered by the cattle thief to be a proof of ownership without a brand, but, as they could be read at a much greater distance than the latter, they saved the cowboy many hours of riding. The earmark was usually described as "right top-bit, left full-crop," or "right slit, left half-crop and slit," etc.

**EARN,** *ern*. A river and loch in the south of Perthshire, Scotland, in the beautiful valley of Strathearn (Map: Scotland, E 3). The loch is 6½ miles long, 1 mile wide, and 287 feet deep, and bordered by rugged hills. The river Earn flows east from the loch for 49 miles, past Comrie, Crieff, and Bridge of Earn (a popular summer resort), into the estuary of the Tay, 7 miles southeast of Perth. The river is navigable for small vessels as far as the Bridge of Earn. Along the river, near Abernethy, under a thick bed of clay, is a peat bed 2 or 3 feet thick, supposed to be a continuation of the submarine forest at Flisk.

**EARNEST** (from Welsh *ernes*, *ern*, pledge). A coin or other article, usually of trifling value, given by a purchaser to his vendor "to bind the bargain" of sale. The practice is one of great antiquity and belongs to the order of ceremonial transactions so common in all early legal systems, the validity of which turns on the due observance of a prescribed form of proceeding rather than upon an inquiry as to the real intention of the parties thereto. The giving of earnest is, therefore, not at all the same thing as part payment on the one side or part delivery on the other, with which it is often confused; and, in the case of earnest proper, no allowance is made for the value of the coin or token given upon the settlement of the transaction. Notwithstanding its quaint and antiquated character, the giving of earnest is still recognized in the law of England and the United States as the equivalent of the consideration essential to the validity of a contract. The Statute of Frauds (29 Car. II, c. 3), as now existing in England and reenacted in the United States, not only recognizes the legal validity of the act of giving earnest, but makes the distinction between it and the act of making part payment.

**EARRING.** An ornament suspended from the lobe of the ear, which may or may not be pierced for the purpose. The practice of wearing earrings is of the highest antiquity. In the ancient world there was a marked difference between the Asiatic races, among whom earrings were worn by both sexes, and the Greeks and Romans, whose women alone used them. Earrings have always formed an important branch of artistic jewelry.

**Egypt and Assyria.** Among the Egyptians the earliest rings were extremely simple—either single hoops of gold, from 1½ to 3 inches in diameter, or several hoops (as many as six) soldered together. Royal earrings were sometimes in the shape of an asp set with precious stones. Later forms, copied from Asiatic and Hellenic models, show the ring ending in the form of a dragon or antelope's head; others are pendants in the form of a vase, with incrustated work or with heads of divinities in relief. But the earliest homes of the really artistic earring were Babylonia, and later Assyria, where it

was a sign of rank among the men. Kings, nobles, and soldiers, as well as gods and genii, wore earrings; the Assyrian bas-reliefs show the variety of their design. Their general form is that of a pendant, sometimes a long drop or cone attached to a heavy ring or crescent, and often, especially under the later kings, that of a cross or groups of balls, lion-headed or bull-headed genii, the symbols of Assur and other gods. The materials were gold and silver; pearls were sometimes added. Molds for earrings have been found among the Assyrian palaces at Koyunjik and Nimrud. While the size and decoration were always kept within bounds by the Assyrian jewelers, greater gorgeousness was aimed at by the Persians as well as by the goldsmiths of Phœnicia, Syria, and the pre-Hellenic peoples of the Ægean. The statues from Cyprus, the tombs of Syria and of Sidon, show Assyrian influence enriched.

**Greek and Etruscan.** The Mycænæan and Homeric women used rich earrings. At Mycenæ and Hissarlik (Troy) the discoveries of Dr. Schliemann included many early gold earrings of different shapes—the bell-and-chain pendant, the fringe pendant, the gondola, the claw-shaped, the circular plaque, and several more. In the *Iliad* (xiv, 182-183), Hera wears earrings ending in three drops. The true gorgeousness of this period may be inferred from the examples found at Camiros in Rhodes; they are long pendants, with rectangular plaques, diversified by zones of nude figurines and heads joined by little chains hanging from rosettes of filigree work. Henceforth earrings fall into two main classes: (1) those worn against or close to the lobe of the ear and sometimes entirely concealing it; (2) those that hang below the ear and aim to continue its lines, not to conceal them.

The pre-Hellenic and Hellenic earrings, forming an elaborate network of design in several stories, appear to have influenced the Etruscans more than the later Greeks; for the Greek earrings of the sixth and fifth centuries B.C. are extremely simple and small, and it is not until the fourth, and especially the third, century B.C. that the richer Hellenistic art returned to the more elaborate style of design. The Etruscan tombs furnish the largest number of examples for the early part, those of southern Russia for the later part, of this period. The museums containing the largest number are: the Gregorian Museum at the Vatican, the Campana collection at the Louvre, the Castellani collection at the British Museum, the Metropolitan Museum in New York—all of which have been gathered from the contents of Etruscan tombs—and the Hermitage collection at St. Petersburg, with the superb series from southern Russia, especially from Kertch. They must be classified into two series: votive earrings, of very thin gold and frail workmanship, made only for burying with the deceased; and earrings for use, of heavier workmanship. The Etruscan tombs contain earrings that are both Italian and Greek—it is not easy to distinguish them. They form the most numerous and continuous series of ancient times, giving the styles during about 600 years. The material is gold, embossed, with filigree and granulated work, of the famous technique which modern jewelers, headed by the great antiquarian artist, Castellani, have tried to revivify. The main Etruscan designs are the following: the handbag shape, formed of a plaque with handle, dec-

orated with spirals, granulations, balls or figured designs, linear or in relief—an early form, seventh century; the gondola shape, with a bunch of three drops decorated with little groups of pearls, popular in the sixth century; the ear plaque, a disk usually circular, but sometimes oval, square, or oblong, with borders and zones of ornamental designs in relief and filigree and with its pendent bunch of drops, as in the previous kind used in the fifth and fourth centuries; the ring with pendant, usually large and sometimes with a diminishing series of single drops, a style frequent in the latest tombs of the fourth and third centuries. Some unusual specimens do not belong to any of these types. An exquisite pair of late workmanship from Bolsena, now in the Louvre, has for its central piece a vase, surmounted by Apollo as sun god, drawn by four horses in a chariot, and accompanied by winged Victories; its artistic beauties are to be seen only under a magnifier. Another beautiful pair from southern Russia, among the many at St. Petersburg, has as centre a circular plaque with a Nereid on a Triton in relief. Such elaborate works have a profusion of hanging figurines, flowers, fruits, birds, vases, chain nets, and their goldwork is often enhanced by colored enamels. The late-Greek artists in the service of the kings of the region of the Bosphorus, whose works abound in southern Russia, appear to have excelled all others. Both Greek and Roman statues exist with the lobes of their ears bored for earrings—as in the Medici Venus.

**Roman.** The Romans naturally inherited the taste from the Etruscans and later borrowed forms from late-Greek art. Pliny says (xi, 50) that there was no part of dress on which greater expense was lavished; and Seneca mentions one worth a patrimony, consisting of four pearls above and below a central precious stone. Roman artists popularized for the first time the use of precious stones in earrings. It was characteristic that they valued them, not as the Greeks had, for beauty or workmanship, but for the value of the material. Roman earrings were therefore much less artistic, and jewels, especially pearls and emeralds, replaced gold, almost entirely excluding the old methods and designs. This decadence was accentuated during the later Empire. It is interesting to note that the Roman poets and writers speak of distinguishing an Oriental man by his use of the earring.

**Byzantine and Barbaric.** Proof that it still remained the custom in the East for the men to wear earrings even later is given by several Byzantine works of art, such as the mosaics representing Justinian and Theodora at Ravenna, and ivories of later Byzantine rulers, in which the emperors as well as the empresses wear earrings. The type of loop earrings and those with filigree work were, however, perpetuated even through the early Christian period, with ornaments of spirals and pellets, bands, circles, and even birds, found in Egyptian, Italian, and other tombs. The barbarous tribes of the North, who destroyed Roman civilization, varied in their use of the earring. The Goths, coming from farther east, were partial to them, with heavy gold and enamel designs; and in this they were somewhat rudely imitated by the Lombards. The Merovingian Franks affected a simple ring, with one or more stones set in the centre. But the Anglo-Saxons hardly used any. Many, however, are found in the early graves of Belgium,

France, Rhenish and Bavarian Germany, and especially Hungary, although none approach the beauty of classic or Etruscan design. Cloisonné enamel was a novelty in technique, introduced by these northern jewelers.

**India.** It is an interesting fact that late-Greek designs appear to have been perpetuated in Indian jewelry—in Cashmere and the Punjab, the style with gems and enamels; in Tibet, that with heavy gold forms; in the region of Orissa and in other northern provinces, the filigree and granular work. Indian earrings are the most gorgeous and artistic perpetuation in recent times of the ancient styles. At the same time the ancient designs of Assyria and Phoenicia are in part perpetuated among the modern Arab and Syrian tribes.

**The Renaissance.** The Middle Ages in Europe abandoned the earring in the circle of high life, the custom being perpetuated only by the peasantry. The innumerable works of art reproducing the costume of the period between the tenth and fifteenth centuries show hardly a single earring. The change of taste came during the Renaissance, especially on the approach of the sixteenth century. The Italian jewelers furnished models for nearly all Europe, and the technique reverted to goldwork with frequent use of enameling and precious stones. The pendent type was universally employed, of many shapes, based on the circle, the cross, the heart, the drop. There was every variety of style, from heavy embossed work in solid metal, often with figures in high relief, to the even more favorite form of lacelike openwork in the rather regular geometric patterns of Renaissance design, with occasional free use of foliage and flowers, though never so realistic as in ancient jewelry. Portuguese, Spanish, German, French, and English work of the sixteenth and early seventeenth centuries, while based on Italian originals, developed national characteristics; and this style, sinking into the middle and peasant classes, has been perpetuated by them, alongside of even more antique patterns, up to the present time. It was among the jewelry of the peasants of modern Tuscany that Castellani found the lost secrets of the Etruscan jewelers. The so-called peasant jewelry of Europe, as first shown by the Paris Exhibition of 1867 (now in South Kensington Museum), presents the only modern characteristic European work comparable to that of modern India in regard to earrings as well as other branches of the art. In many primitive parts of Europe—the Basque Provinces, Brittany, Normandy, and southern Italy—the men as well as the women wear earrings, but usually in the form of simple rings. Between 1876 and 1880 the earring began to disappear in Western Europe, England, and America. From 1885 to 1905 the earring was scarcely seen in the upper classes of society, and the custom of piercing the lobe of the ear fell into disuse. In the opening decade of the twentieth century the earring began to return, long earrings, 1914, being worn in England, short, in France and America, but without piercing the ear. Consult: Hadaczek, *Der Ohrschmuck der Griechen und Etrusker* (Vienna, 1903); Rae, "On Antique Earrings and Ear Pendants," in the *Connoisseur* (London, 1906); Bennet, "A Collection of Earrings," in the *Connoisseur* (ib., 1909); and especially the bibliography of JEWELRY.

**EAR SHELL;** or ORMER. See ABALONE.

**EARS-TO-EAR BIBLE.** See BIBLE, CURIOUS EDITIONS OF.

**EARTH, FIGURE OF.** See GEODESY.

**EARTH, THE** (AS. *eorpe*, Icel. *jörp*, Goth. *airpa*, Teut. *Hertha*, OHG. *erde*, Ger. *Erde*, earth; connected with Gk. *ἔρα-ζε*, *era-ze*, on the ground, and possibly with Lat. *arvum*, field, *arare*, Gk. *ἀρᾶν*, *aroun*, OChurch Slav. *orati*, Ir. *araim*, Goth. *arjan*, Icel. *erja*, OHG. *erian*, dialectic Ger. *ären*, *eren*, AS. *erian*, archaic Eng. *ear*, to plow). The planet on which we live, the third in order of distance from the sun, and the largest within the orbit of Jupiter.

**The Form and the Magnitude of the Earth.** To a spectator so placed as to have an unobstructed view in all directions, the earth appears a circular plain on whose circumference the vault of heaven seems to rest. In ancient times even philosophers looked upon the earth as a flat disk swimming upon the water. But many appearances were soon observed to be at variance with this idea, and even in antiquity the curved form of the earth began to be suspected. It is only by assuming the earth to be curved that we can explain how our circle of vision becomes wider as our position is more elevated, and how the tops of towers, mountains, masts of ships, and the like, come first into view as we approach. There are many other proofs that the earth is a globe. Thus, as we advance from the poles towards the equator, new stars, formerly invisible, come gradually into view; the shadow of the earth upon the moon during an eclipse is always round; the same momentary appearance in the heavens is seen at different hours of the day in different places on the earth's surface; and lastly, since 1519 the earth has been circumnavigated innumerable times. It is not, however, strictly true that the earth is a sphere; it is slightly flattened or compressed at two opposite points—the poles—as has been proved by actual measurement of degrees of latitude (q.v.) and by observations of the pendulum. It is found that a degree of a meridian is not everywhere of the same linear length (see DEGREE OF LATITUDE), as would be the case if the earth were a perfect sphere, but increases from the equator to the poles, from which it is rightly inferred that the earth is flattened there. A pendulum, again, of a given length is found to move faster when carried towards the poles and more slowly when carried towards the equator; which shows that the force of gravity is less at the equator than at the poles, or, in other words, that the centre is more distant at the former than at the latter. The diminished force of gravity at the equator has, it is true, another cause—viz., the centrifugal force arising from the rotation of the earth, which acts counter to gravitation, and is necessarily greatest at the equator, where the linear velocity of rotation is greatest, and gradually lessens as we move northward or southward, till at the poles it is nothing. But the diminution of the force of gravity at the equator, arising from the centrifugal force, amounts to only  $\frac{1}{231}$  of the whole force; while the diminution indicated by the pendulum is  $\frac{1}{190}$ . The difference, or  $\frac{1}{115}$  nearly, remains assignable to the greater distance of the surface from the centre at the equator than at the poles. From the most accurate measurements of degrees that have been made, the flattening or ellipticity of the earth has been determined at  $\frac{1}{231}$  nearly; or the equatorial radius is

to the polar as 300 to 299. These measurements of degrees determine not only the shape, but also the size of the earth. It is thus found that the equatorial semidiameter amounts to 3963 miles, while the polar semidiameter is 3950 miles.

**The Mass and Density of the Earth.** There are several methods of weighing the earth: I. The first method is by observing how much the attraction of a mountain deflects a plummet from a vertical line. This being observed, if we can ascertain the actual weight of the mountain, we can calculate that of the earth. This method was first used by Bouguer, who in 1740 attempted to measure the deviation in the plumb line produced by the horizontal attraction of Chimborazo, a mountain in the Peruvian Andes nearly 20,000 feet high. Although the experiment was not very satisfactory, still it showed that a deviation was actually produced, and about 35 years later the method was employed with greater success by Maskelyne. From experiments performed in 1774-76 at Schiehallion, in Perthshire, Scotland, he calculated the earth's mean density to be five times that of water. Schiehallion is a large mountain, lying east and west, steep on both its northern and southern faces, and of such a shape that it is possible to calculate both the mass, and the attraction which it exerts, with a considerable degree of exactness. The observed deflection of the plummet in these experiments was about six seconds. The same method was used in 1855 by Colonel James, director of the Ordnance Survey, Arthur's Seat, near Edinburgh, being used as the attracting mountain. The value which he obtained for the mean density of the earth was 5.32. II. A second method, which was also first used by Bouguer in Peru, is by observing the times of swing of a pendulum at the surface and also at the summit of a high mountain. It is then possible to determine the attraction of the earth as compared with that of the mountain, and, as the latter can be calculated when the shape of the mountain and the density of its component rocks are known, the attraction of the earth is easily found. Experiments of this kind were performed in 1821 by Carlini on Mont Cenis, in 1865 by Pechman at Gerold in the Alps, in 1880 by Mendenhall at the summit of Fujiyama in Japan, and in 1892 by Preston on Mauna Kea in Hawaii. A modification of this method was introduced by Airy. Instead of swinging the pendulum at the top of a mountain, he observed its time of swing at the bottom of a deep mine. In this way the attraction of the whole earth was compared with that of the spherical shell of the earth's crust whose inner surface passed through the bottom of the mine. His first attempt to carry out the experiment at the Dolcoath copper mine in Cornwall, England, proved abortive, but in 1854 he performed it at the Harton Pit, near Sunderland, and obtained for the mean density of the earth a value of about 6.5. Similar experiments were made in 1883 and 1885 by Von Sterneck in silver mines in Bohemia and Saxony. In the methods just described, however, there must always be uncertainty, however accurate the observations, in regard to the mass or weight of the mountain or, in the case of the mine experiments, of the shell of the earth's crust. III. The method known as Cavendish's is much freer from liability to error. This method was first employed in 1798 by Henry Cavendish on the sug-

gestion of Michel and has since been repeated with various modifications by Reich, Bailly, Cornu and Baille, Wilsing, Boys, Braun, and Eötvös. In the apparatus used by Bailly, a fine rod carrying two small balls at its extremities is suspended by a wire and the position of the balls is carefully observed by the aid of a telescope. Large balls of lead placed on a turning frame, the centre of which is in the prolongation of the suspending wire, are then brought near the suspended balls in such a way that they can affect them only by the force of their attraction. On the large balls being so placed, the small ones move towards them through a small space, which is carefully measured. The position of the large balls is then reversed—i.e., they are placed at the same angular distance on the other side of the small balls—and the change of the position of the small balls is again observed. Many observations are made, till the exact amount of the deviation of the small balls is ascertained beyond doubt. Then by calculation the amount of attraction of the large balls to produce this deviation is easily obtained. Having reached this, the next question is, What would their attraction be if they were as large as the earth? This is easily answered; and hence, as we know the attractive force of the earth, we can at once compare its mean density with that of lead. Bailly's experiments lead to the result that the earth's mean density is 5.67 times that of water. In most of the determinations made by Cavendish's method the attracting and the attracted masses used were of considerable size. By employing a quartz fibre as the torsion wire, Boys made it possible to use as the attracted masses gold balls only  $\frac{1}{8}$  of an inch in diameter, while the attracting masses, which were of lead, were only  $\frac{1}{2}$  inches in diameter. IV. A fourth method, which has been successfully employed in various forms by Von Jolly, Poynting, and Richarz and Krigar-Menzel, consists in using an ordinary chemical balance and in determining the change of weight when a large attracting body of known shape and mass is placed above or below the scale pan which carries the mass to be weighed. In the experiments of Richarz and Krigar-Menzel the attracting body was a rectangular mass of lead of nearly 100 tons.

The values of the earth's mean density obtained by the various experimenters referred to in the foregoing account are summarized in the table given below:

OBSERVER	Date	Method	Mean density
Maskelyne . . . . .	1775	I	5.00
Cavendish . . . . .	1798	III	5.45
Carlini . . . . .	1821	II	4.84
Bailly . . . . .	1843	III	5.67
Reich . . . . .	1852	III	5.58
Airy . . . . .	1854	II	6.57
James . . . . .	1855	I	5.32
Pechman . . . . .	1865	II	6.13
Cornu and Baille . . . . .	1878	III	5.50
Mendenhall . . . . .	1880	II	5.77
Von Jolly . . . . .	1881	IV	5.69
Sterneck . . . . .	1883	II	4.77
Sterneck . . . . .	1885	II	6.77
Wilsing . . . . .	1889	III	5.56
Poynting . . . . .	1891	IV	5.49
Preston . . . . .	1892	II	5.13
Boys . . . . .	1895	III	5.53
Braun . . . . .	1896	III	5.53
Eötvös . . . . .	1896	III	5.53
Richarz and Krigar-Menzel . . . . .	1898	IV	5.51
Burgess . . . . .	1902	III	5.55

It will be observed that the values most recently obtained are in substantial agreement, and it is therefore probable that the true value of the earth's mean density is very nearly 5.53. The density of the earth being known, its mass or weight is easily calculated and made a unit for measuring that of the other bodies in the solar system. It is estimated that the mass of the earth is 6000 billions of billions of tons.

**The Motions of the Earth.** The earth, as a member of the solar system, moves along with the other planets round the sun from west to east. This journey round the sun is performed in about  $365\frac{1}{4}$  days, which we call a year (solar year). The earth's path, or orbit, is not a circle, but an ellipse of small eccentricity, in one of whose foci is the sun. It follows that the earth is not equally distant from the sun at all times of the year; it is nearest, or in perihelion, at the beginning of the year, or when the Northern Hemisphere has winter; and at its greatest distance, or aphelion, about the middle of the year, or during the summer of the Northern Hemisphere. The difference of distance, however, is too small to exercise any perceptible influence on the heat derived from the sun, and the variation of the seasons has a quite different cause. The least distance of the sun from the earth is over 91,000,000 miles, and the greatest over 94,000,000; the mean distance is commonly stated at 92,900,000 miles. (See PARALLAX, SOLAR.) If the mean distance be taken as unity, then the greatest and the least are respectively represented by 1.01677 and 0.98323. It follows that the earth yearly describes a path of upward of 560,000,000 miles, so that its velocity in its orbit is about 19 miles a second.

Besides its annual motion round the sun, the earth has a daily motion or rotation on its axis, which is performed from west to east and occupies exactly 23 hours, 56 minutes, 4.09 seconds of ordinary mean solar time. On this motion depend the rising and setting of the sun, or the changes of day and night. The relative lengths of day and night depend upon the angle formed by the earth's axis with the plane of its orbit. If the axis were perpendicular to the plane of the orbit, day and night would be equal during the whole year over all the earth, and there would be no change of seasons; but the axis makes with the orbit an angle of  $23.5^\circ$ , and the consequence of this is all the variety of seasons and of climates that we find on the earth's surface, for it is only for a small strip (theoretically for a mere line) lying under the equator that the days and nights are equal all the year; at all other places this equality only occurs on the two days in each year when the sun seems to pass through the celestial equator—i.e., about March 21 and September 23. From March 21 the sun departs from the equator towards the north, till, about June 21, he has reached a northern declination of  $23.5^\circ$ , when he again approaches the equator, which he reaches about September 23. He then advances southward and about December 21 has reached a southern declination of  $23.5^\circ$ , when he turns once more towards the equator, at which he arrives March 21. The 21st of June is the longest day in the Northern Hemisphere and the shortest in the Southern; with the 21st of December it is the reverse. The linear velocity of axial rotation at the earth's surface evidently increases gradually from the poles to the equator, where it

is about 24,840 miles a day, or about 1440 feet in a second. A direct proof of the rotation of the earth is furnished by experiments with the pendulum, which, as we have already pointed out, show a decrease of the force of gravity from the poles towards the equator; and though a part of this decrease is owing to the want of perfect sphericity, a part also arises from the centrifugal force caused by the motion of rotation. Another direct proof of rotation may be drawn from the observation that bodies dropped from a considerable height deviate towards the east from the vertical line. The analogy of our earth to the other planets may be also adduced as an argument, since their rotation, with the exception of the smallest and the most distant, is distinctly discernible. Finally, an additional proof of the earth's rotation was given in 1851 by Foucault's experiment with the pendulum. The principle of the experiment is this—that a pendulum once set in motion, and swinging freely, continues to swing in the same plane, while at any place on the earth the plane of the meridian continues to change its position relative to this fixed plane. This experiment, being tried, verified the expected rotation most satisfactorily.

If the turning of the earth on its axis is once admitted to be the cause of the apparent daily motion of the heavens, it is an easy step to consider the annual motion of the sun through the constellations of the zodiac as also apparent and arising from that revolution of the earth about the sun which we have already mentioned. If we consider that the mass of the sun is about 332,000 times greater than that of the earth, and that by the laws of mechanics two bodies that revolve round each other must revolve about their common centre of gravity, the idea of the sun revolving about the earth is seen to be simply impossible. The common centre of gravity of the two bodies, being distant from the centre of each inversely as their respective masses, is calculated to be far within the body of the sun, which has a diameter of 866,400 miles. But it is easy to see how the apparent motion of the sun on the ecliptic naturally arises from a motion of the earth about the sun. The motions of the planets, also, that appear so complicated and irregular as seen by us, can be satisfactorily explained only by assuming that they, too, revolve round the sun in the same direction as the earth. See the articles PRECESSION and NUTATION for an account of a small periodic motion of the earth's axis and its effects.

**The Earth's Temperature.** The phenomena of heat on the earth's surface are described under CLIMATE; METEOROLOGY; and other heads. As we go below the surface, we reach a depth beyond which the interior of the earth seems to have no sympathy with the external causes of heat or cold, and its heat appears to be its own and to increase according to a fixed law the deeper we descend. The average rate of observed increase is  $1^\circ$  F. for a descent of between 40 and 50 feet. The distribution of the land and water surfaces, with their area, is discussed in the article GEOGRAPHY (q.v.). For the physical features of the earth, see GEOLOGY.

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**EARTH CHESTNUT.** See EARTHNUT.

**EARTH CLOSET.** See SEWAGE.

**EARTH EATING.** The practice of eating clay. See GEOPHAGY.

**EARTHENWARE.** See POTTERY.

**EARTH HOG,** or **EARTH PIG.** A name for the aard-vark (q.v.).

**EARTH LODGE.** The specific name for the type of house formerly used by the Mandan, Hidatsa, Arikara, Pawnee, Ponca, Omaha, and perhaps other tribes of the Mississippi valley. A circular pointed framework of logs was set up, covered with fine brush or grass, and the whole given a heavy coating of earth. The lodge was in no sense an underground house, though the surface soil within was removed to the depth of 2 or 3 feet to secure a firm earth floor. (See INDIANS, AMERICAN.) True subterranean houses were used by the natives of Alaska and parts of British Columbia, Washington, and California. Jochelson has traced a possible historical connection between these American examples and the subterranean houses of northern Asia and ancient Europe. Consult *Proceedings of the International Congress of Americanists* (Quebec, 1906); also Wissler, in the *Proceedings of the Vienna meeting* (1909).

**EARTHLY PARADISE, THE.** A series of narrative poems by William Morris, modeled on Chaucer's *Canterbury Tales* and published in 1868-71. The separate poems are mythological stories told by Norwegian voyagers in search of an earthly paradise.

**EARTHNUT.** A popular name for the tubers of certain umbelliferous plants, particularly *Carum bulbocastanum* and *Conopodium flexuosum*, which are common in most parts of Europe. Names of the same signification are given to them in a number of European languages. Pignut is another common English name, because pigs are very fond of them. They are also called earth chestnut, from their resemblance in taste and qualities to chestnuts. They are wholesome and nutritious and form an article of trade in Sweden and have sometimes been recommended as worthy of more attention than they have yet received. *Carum ferulaefolium* likewise affords tubers, which are used as food in Greece. The somewhat similar tubers of other umbelliferous plants, as *Eranthis pimpinelloides* and *Chaerophyllum tuberosum*, are sometimes also used for food. The name "earthnut" is sometimes extended to other small tuberous roots or subterranean fruits of similar quality, although produced by botanically unrelated plants, as *Apios tuberosa* (used as food by Indians on the North Atlantic coast), *Lathy-*

*rus tuberosus*, *Cyperus rotundus*, *Arachis hypogaea*, etc.

**EARTHQUAKE.** A tremor or shaking of the ground produced by natural subterranean concussion, from tectonic or volcanic causes. The disturbance is not necessarily violent or even sensible to ordinary means of observation, but can be detected by the delicate instruments which have been devised for recording the vibrations in their passage through the earth. The record of an earthquake thus obtained has a definite character and is readily distinguishable from the motion set up by artificial disturbances, e.g., underground explosions, artillery fire, or the movement of heavy traffic on a city street. With the recent advances in the instrumental methods of investigation it has been found that earthquakes are much more common than had been supposed; in fact, they are of daily occurrence in some parts of the world, and the range of the vibrations set up by a heavy shock extends over the whole globe. The average seismic frequency is probably greatest in Japan, where records for a period of eight years showed a total of 8831 shocks, or an average of 3 a day. The larger number of these belong to the class of *microseisms* (unfelt disturbances); the destructively violent types, or *macroseisms*, are relatively rare, and then may be centred in remote localities or under the sea so as to attract little notice.

**Succession of Phenomena.** The phenomena manifested by a powerful earthquake within the zone of destruction vary considerably according to the position of the place of observation with regard to the focus of the disturbance, the relative intensity, and the nature of the ground at that place. Consequently the course of events may appear quite differently to observers stationed at different points within the zone. The first phase, however, is usually a slight trembling or a series of separate shocks that last a few seconds; then follows almost immediately a violent motion, which in some instances seems to consist of an actual rising and falling of the ground in waves that advance with great rapidity and in other cases involves more of a horizontal to-and-fro movement, or shakings of short amplitude but extremely rapid. The violent motion lasts only a fraction of a minute usually and subsides into smaller vibrations that gradually diminish to insensibility. An earthquake of this kind is almost always accompanied by sounds, which, also, are heard sometimes with moderate shocks. The sounds may precede or follow the main vibrations, and in some cases sound and shock appear to be simultaneous. The sounds are variously described as resembling the rumbling of thunder, the roar of heavy artillery, and the crashing of an immense mass of glass; no doubt they are frequently confused with the noise produced by falling objects, the crushing of timbers, etc., which is a sequence rather than an accompaniment of the shock itself. The actual sound is a low pitched rumbling and is caused by the vibratory motion of the air in sympathy with the ground waves. It always appears to issue from the earth, but, contrary to popular belief, is not actually transmitted through the rocks.

The suddenness of a violent disturbance makes contemporaneous observation very difficult, while escape from its effects is almost impossible. The main shock is announced only by a brief period of minor tremblings and is over in a



minute or two after the first motion. Premonitory tremors may occur at intervals for several days or months previous to the earthquake, but in a country where slight shocks are frequent their real time of safety has passed. The display of energy within the brief period is without parallel in any other manifestation of natural forces. The zone of destruction of a powerful disturbance extends over many thousand square miles, and within the narrower epicentral tract the havoc wrought upon life and property is beyond the power of realization for those unacquainted with disasters of the kind. The Messina earthquake of 1908 demolished the whole city, so that scarcely a building was left standing, and did extensive damage to the adjacent districts of Sicily and the Italian mainland, involving a loss altogether of nearly 80,000 lives. Volcanic outbursts alone are attended by similar scenes of violence and horror, yet they are incapable of accomplishing such widespread destruction.

**Earthquake Motion.** Earthquakes travel through the earth as elastic waves. The rocks which form the outer zone of the earth, or the so-called crust, as well as the underlying layers, which are of uncertain nature, behave within certain limits like elastic media, transmitting vibrations in a manner similar to the air when set in motion by sound. Any jar or disturbance of equilibrium within the rock mass produces a series of waves of alternate tension and compression which advance by communicating the motion from particle to particle. The vibrations may take place in the same direction as the disturbance is transmitted and are then called longitudinal waves, or they may occur at right angles to the direction of travel, when they are known as transverse waves. Both kinds are concerned in the motion of an earthquake. The waves are of small amplitude—a mere fraction of an inch in the unfelt tremors, but possibly an inch or two in the very violent shocks. No actual measurements in the latter case are possible, since no instruments could withstand the terrific shaking. The periods, or time consumed in a single vibration, range from two or three seconds to about half a minute, as measured at a distance from the focus.

In the instrumental record of earthquakes at points without the danger zone it has been found that the wave motion is divisible into different phases, or parts, called the preliminary, the main, and the final phases. The preliminary phase consists of minor tremors, scarcely perceptible at first, but developing into well-marked vibrations of fairly constant period. Some records show two classes of these waves, which are then called the first and the second preliminaries. The main phase develops very rapidly out of the preliminary vibrations into waves of much greater amplitude and longer periods; it corresponds to the destructive part of the disturbance close to the source. The large swings after an interval gradually diminish, and then enters the final phase of small, interrupted tremors which represent probably the refracted and reflected parts of the earlier movements. All of the waves start approximately at the same time from the earthquake centre, but the small tremors of the preliminary phase outravel the longer waves of the principal phase.

From calculations of the times of arrival reported by different stations for the California earthquake of 1906, Reid found that the first preliminaries traveled at a velocity of from 7.2 kilometers a second near the origin to 11.7 kilometers a second at a distance of  $110^\circ$  of the earth's arc; the second preliminaries had a velocity ranging from 4.8 kilometers to 6.4 kilometers; and the main vibrations a constant velocity of 3.75 kilometers a second. There is, thus, not only a variation of relative speeds, but the first and second preliminaries, carried forward perhaps as longitudinal waves, increase their apparent velocity with increasing distance from the source. This relation is regarded as indicating that the waves of the first phase pass through the earth, not perhaps by the shortest path along an arc, but in directions corresponding to the maximum elasticity of the medium. The important practical feature of this variation is that it permits accurate deduction from an instrumental record as to the distance traveled by the disturbance from its source. The data supplied by a series of stations also afford the information necessary to deduce the direction of wave propagation, so that from the known factors of distance and direction the disturbance may be traced to its origin.

The structure and nature of the rocks have effect upon the transmission of the wave motion, causing refractions and variations in speed and intensity, which would not be possible if the earth were a uniform solid. Certain localized areas within the zone of destruction may be much less affected than the rest of the area; also shocks are sometimes felt in mines that escape observation at the surface and vice versa. The greatest damage to structures results when they are placed on alluvial or made ground; it appears that loose materials accentuate the wave motion, or rather perhaps transform the tremors into slow undulations of greater amplitude, at the same time that they may be subjected to a propulsive action.

**Depth of Source.** The source from which the waves emanate is known as the focus, or centre, and the place above the focus on the surface, as the epicentre. The terms rather imply that a disturbance begins at a point or within a very limited zone, but such is not the case—at least for all tectonic earthquakes, the most common and damaging kind. The focus involves a mass of three dimensions, and the epicentre may be an area of several hundred square miles. The determination of the depth of the focus for different shocks has been attempted by Mallet, Dutton, and others, but without any very conclusive results. The method used by Mallet rests upon observations of the effects produced in walls and buildings, on the assumption that the cracks develop mostly at right angles to the direction of wave emergence; it is not very reliable, owing to the numerous refractions and reflections the waves undergo before emerging at the surface. The general consensus of opinion, however, is that the focus is relatively shallow, probably not more than 10 or 20 miles from the surface in most shocks.

**Relative Magnitude.** The area affected depends directly upon the violence and probably also upon the depth of focus. No practical means have been found to measure the absolute degree of intensity or the energy developed by a shock. A scale of relative intensities, known as the Rossi-Forrel scale, is much used by seismologists.

mologists and is based partly on the personal sensations of individuals within the disturbed area and in part upon the external effects. The scale is arranged in ascending order of intensity, as follows: 1. Unfelt, only recorded by instruments. 2. Very feeble. 3. Feeble. 4. Light, felt by persons in motion. 5. Moderate, felt by every one. 6. Fairly strong, sleepers awakened, clocks stopped. 7. Strong, general panic. 8. Very strong, chimneys fall. 9. Extremely strong, partial or total destruction of buildings. 10. Disastrous, fissures opened, widespread ruin. Around the epicentral tract may be drawn curves which will indicate the relative intensity of the shock within the places thus joined; such curves are called *isoseisms*. Similarly, *coseisms* are curves about the epicentre that connect places having the same times of arrival for any particular phase.

The damage inflicted by an earthquake is not necessarily proportional to its magnitude or intensity, since much depends upon how thickly the epicentral area is populated. The California shock of April 18, 1906, was not extraordinarily heavy compared with some other examples, although its destructive effects extended over a tract 350 miles long and 70 miles wide, disturbed an area of about 175,000 square miles, and involved tremendous financial losses. Most of the damage in San Francisco itself was incident to the fire, which on account of the disrupted water mains could not be brought under control. The Messina earthquake in 1908 had a limited epicentre within a populous district, where the buildings were ill adapted to withstand even moderate shakings. The loss of life from the disaster was officially reported as 77,283, far exceeding the number of deaths from any other earthquake of which there is authentic knowledge. Some of the most violent shocks have occurred in Japan and India. The Indian earthquake of 1897 was one of the heaviest in modern times, while that of 1905 in the vicinity of Kangra was reported to have been felt over an area of 1,625,000 square miles and was responsible for the death of 20,000 natives. The Charleston, S. C., shock of Aug. 31, 1886, the most violent of any recorded in the United States east of the Mississippi River, was perceptible over an area 800 miles wide and 1000 miles long. The Lisbon disturbance of 1755 appears to have been very intense, as it was also exceptionally destructive; a notable feature was the immense sea wave which swept the coast of Portugal and greatly aggravated the disaster, in which altogether 40,000 people were killed.

**Origin.** The question as to the causes of earthquakes has been a subject of speculation since very early times, but it is only with the adoption of scientific principles of investigation aided by instrumental experimentation during the last century or so that real progress has been made towards a solution. The question is difficult because the origin of disturbances lies within the hidden depths of the earth, and the exact conditions obtaining there can only be inferred from insecure data. It is now generally recognized, however, that two principal causes are concerned—the one tectonic and the other volcanic. The first refers to crustal dislocations, particularly the differential movements along fissures known as faults. From time to time stresses accumulate in the strata to a point where the elastic limit is exceeded, and then rupture and a slip result by which

equilibrium is once more restored. Such faults are very common, as may be observed from their surface indications in nearly all regions, and imply the ceaseless operation of enormous forces. The source of the stresses may possibly be the shrinking of the earth's interior away from the superstructure by reason of cooling, or the extrusion of igneous matter, or the escape of gases; the cause is not definitely known, but the immediate effects are very apparent. When fissures are once opened, they may serve repeatedly to relieve stresses. Thus, the last California earthquake is traceable to the recurrence of displacement along the San Andreas fault, previously marked out by other movements as a prominent feature in the coast region from Berkeley on the southeast to Humboldt County on the northwest. On the opposite sides of the fault plane the strata shifted horizontally a distance ranging from 7 or 8 feet up to 21 feet. In places also there was a vertical movement of from 1 to 3 feet. As the total length of the fault is estimated at 270 miles, the momentum of the mass involved must have been enormous. The tectonic earthquakes are the most numerous and probably account for nearly all disasters of seismic origin. Those of volcanic nature seldom seem to have far-reaching effects, though adding much to the terrifying aspects of the eruption which they accompany. They are traceable to concussions within the volcanic conduit, produced probably by the gases in their progress towards the surface; most of the imprisoned energy, of course, finds release in the eruption. The occasional paroxysmal outbursts of the kind exhibited by some of the Mediterranean volcanoes, or as exemplified by the explosive eruption of Krakatoa in 1883, when a large part of the island was blown into the air, generate fairly heavy shocks. A further cause of earthquakes, generally regarded, however, as not very important, is found in the jars produced by the collapse of caverns that have been hollowed out by underground waters in their circulation through soluble rock materials like limestone, gypsum, and rock salt.

**Earthquake Zones.** If shocks are mainly concomitants of crustal displacement as manifested in the fracture and faulting of rocks, it may be expected they will occur most frequently along lines of structural weakness. Accordingly lofty mountain regions, great inequalities between land surface and adjacent sea bottom, and the presence of fault scarps particularly, furnish some of the conditions necessary for the recognition of seismic areas. It is noteworthy, also, that most of our active volcanoes fall within such areas. The western coasts of North and South America, with their mountain ranges and precipitous shore lines, mark one of the main seismic zones, which joins on the north with another great zone that extends from southeastern Asia across the Japanese Archipelago, the Kurile Islands, and the Alutian chain to the Alaskan mainland. Another has an east-west trend through the Mediterranean, the Azores, West Indies, Central America, Hawaii, East Indies, the Himalayan Range, Persia, and Asia Minor. The eastern coast of America and the western part of Europe are comparatively free from such disturbances.

**Sea Waves and Other Phenomena.** Many of the shocks propagated under the land have submarine origins. A part of the energy or motion in such cases is communicated to the

water, causing a compressional wave that is sometimes felt by ships at sea, though not often with damaging results. A great sea wave (erroneously called a tidal wave) may also be started, and if the epicentre is not too far removed from land the wave will dash upon the coast as a wall of water, sometimes 30 or 40 feet high, with irresistible force. The Messina earthquake, already mentioned, was precipitated by a disturbance in the near-by strait, and the following wave accounted for much destruction along the lower sea front. At San Alessio the water rose 38 feet, but at Messina itself it rose only about 10 feet; the wave reached Malta two hours after the earthquake. The motion in mountain regions not infrequently produces landslips, shaking down immense quantities of earth and rock from cliffs and insecure slopes into the valleys, where they may obstruct the streams so as to form temporary lakes. It has been noticed that glaciers after a disturbance will advance farther into the valleys, owing to the increased supply of snow at their sources contributed by avalanches. Within the epicentral tract the surface features may be modified by local elevations or subsidences of the ground, by the opening of chasms and fissures, by earth flows and the diversion of the drainage systems.

**Seismology.** The study of earthquakes has made notable advances during the last two or three decades and may be said now to rank as one of the coördinate branches of geological science, provided with its own methods and instruments of observation, and followed by a band of workers that number representatives among all the principal countries. The systematic investigations undertaken in Japan, at first under the direction of J. Milne and later carried on by Omori and other Japanese seismologists, stimulated general interest, as they have also proved of great practical value in suggesting methods for mitigating the damage by shocks. At present work in this field is very active; stations equipped with instruments of record have been set up in many places in the United States, Europe, and elsewhere, some under government subsidy. Besides local societies and publications devoted to its interests, there is a central association, the Association Internationale de Seismologie, which issues from time to time valuable reports and is a leading influence in the extension and encouragement of research. The instrument for the registration of shocks is the seismograph (q.v.), which in its improved modern form is capable of detecting tremors from sources on opposite sides of the globe; by it the distance and direction of the larger disturbances may often be determined with great accuracy, and it detects many that otherwise would escape notice.

The principal objects of present inquiry are to discover the centres from which earthquakes most frequently emanate, the relative frequency with which they occur, and any possible relation that may exist between their frequency and other natural phenomena. The mapping of the seismic zones is a work of basic importance, necessary to forearm, if it does not supply the means for forewarning, against disastrous shocks. The ability to locate the origins of submarine disturbances, as shown by Milne, may be put to practical use in the laying out of routes for ocean cables. Frequent breakages of cables occur within zones subject to heavy

earthquakes, involving much loss from disuse and expense of repair. The analysis of the energy developed by the wave motion has a bearing obviously upon the design of buildings and the securing of proper foundations to withstand the strain. For foundations solid rock affords the greatest security, for reasons already explained; where it is impracticable to place buildings upon it some protection may be had by the excavation of a trench on the side from which the earthquakes usually come. Masonry construction and especially masonry arches, chimneys, and exposed ornamental work succumb most quickly; timber and steel structures, properly braced, endure a heavy shaking.

**Earthquake Disasters.** The Charleston, S. C., earthquake and the San Francisco shock, already mentioned, are the only heavy ones that have occurred within the United States in recent years and that have been responsible for widespread destruction. Neither involved a loss of life at all comparable with the losses incident to some that have occurred in other countries. One of the greatest catastrophes of modern times resulted from the Lisbon earthquake of 1755, when that city was overthrown and 40,000 people were killed; the tremors were felt in North Africa, Scandinavia, and as far away as the east coast of North America. Calabria and Messina were visited by an earthquake in 1783 that wrought almost as much devastation as the more recent Messina disturbance, and is said to have entailed a loss of 60,000 lives. Other disasters occurred at Aleppo, in 1822; at Naples, 1857; at Quito, 1859; in Peru, 1868; on the island of Ischia, 1883; and in Japan, 1891. The earthquake in northeast India (Assam) in 1897 was one of the severest that has recently been felt, but its centre fortunately was not in a heavily populated region. The Kangra disturbance of 1905 in the same country involved an area half as large as the United States. Valparaiso was partly destroyed by an earthquake in 1906, the same year as the San Francisco shock. Kingston, on the island of Jamaica, was devastated in 1907. The Messina disaster of 1908 exceeded all others in the completeness with which a great city was ruined and in loss of life. A heavy shock was reported in the Province of Luristan, Persia, in 1909; the city of Cartago, Costa Rica, was laid waste in 1910; and southern Mexico was visited by a damaging shock in 1911.

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**EARTHS.** A term formerly applied to the oxides of a number of elements. The alchemists applied the term in general to bodies that were insoluble or only slightly soluble in water and not changed by heat. With the establishment of modern chemistry by Lavoisier, the earths, which had been regarded as elements, became recognized as compounds. The term "alkaline earths" is still generally applied to the oxides of barium, calcium, and strontium, and sometimes to that of magnesium.

**EARTHSHINE.** The reflection from the moon of the light cast upon her by the earth, particularly noticeable on clear nights at the time of new moon, when sometimes the whole surface of the moon can be seen in ashy-colored light.

**EARTH SNAKE.** See SHIELDTAIL.

**EARTHSTAR** (translation of Neo-Lat. *Geaster*, from Gk. γῆ, *gê*, earth + ἀστήρ, *astēr*, star). A genus of puffballs which at the time of spore dispersal open in a starlike form. Before the period of spore dispersal the earthstar has a rounded or pear-shape form, seldom more than 2 inches in diameter. When the spores are ripe, the outer leathery layer of the skin, or periderm, splits radially from the central apex into a number of triangular segments, which spread so as to assume a starlike arrangement and then become strongly reflexed. In certain species, particularly in *Geaster hygrometricus*, this periderm is very sensitive to humidity and dryness, with the result that the plant expands during moist periods and closes up during dry ones. Earthstars are found in nearly all parts of the world, some species being restricted to particular regions, while others are cosmopolitan. In America they are quite common in pastures and open woodlands. A puffball is merely the spore-bearing portion of a fungus, whose vegetative body (mycelium) branches extensively through the substratum. See BASIDIOMYCETES; FUNGI, and its accompanying Plate.

**EARTHWOLF.** A name for the aard-wolf (q.v.).

**EARTHWORKS, MILITARY.** A fortification, either temporary or permanent, constructed principally with earth. The principal classes of field or temporary fortifications or earthworks are *hasty intrenchments*, *deliberate intrenchments*, and *siege works*. There are many forms of earthworks, for which see FORTIFICATION; REDOUBT; TRENCH.

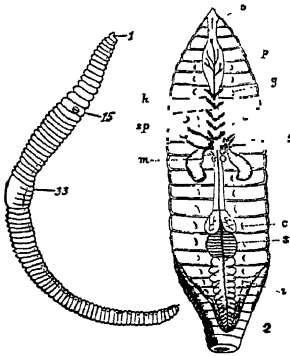
**EARTHWORM.** The popular name for worms of the family Lumbricidæ, especially the common *Lumbricus terrestris* and *Allobophora foetida*. They belong to the oligochaetous section of the chætopod annelids and are widely distributed in temperate and tropical lands.

**Habits.** Like most other oligochaetes, earthworms are subterranean in their habits and appear above the surface only under unusual conditions, such as excessive rain, which floods

their underground burrows and forces them to the surface to avoid drowning. They also come to the surface to feed and to throw out their "castings," almost exclusively at night; for although they have no eyes, by primitive light-detecting organs they avoid the light. Earthworms are often seen in great numbers upon sidewalks, steps, and paved streets after a wet night or a hard rain, and they are often reported to have actually "rained down." Such cases, however, are easily explained by the fact that the worms crawl about actively in their attempt to get out of the water and even climb up comparatively smooth surfaces, and, as the hard surface of the sidewalk or roadway prevents their reëntering the earth when daylight returns, they are all left exposed to view. Although naturally somewhat sluggish, these worms can burrow with considerable speed, especially in light soil. The burrowing is accomplished not only by forcing the bluntly pointed head between the particles of earth and pressing them apart, but also by actually taking into the mouth and swallowing much of the opposing material. In all their movements the short but stiff setæ, or bristles, along the sides of the body are of the greatest assistance. These setæ are arranged in pairs on each segment, two pairs on each side, so that every segment carries eight setæ, and they form two double longitudinal rows along each side of the worm. Earthworms form the prey of many animals, from slugs upward, and are the principal food of moles, shrews, and the like. Their habit of going into the water, and the accidents of floods, cause many to fall a prey to fishes; and they are the commonest bait for still fishing, whence they are more commonly known in the United States as angleworms than by any other name.

**Earthworms and Soil.** The important part that earthworms play in the economy of nature was not generally recognized until attention was called to it by Charles Darwin. Most of our knowledge of the habits of these creatures is due to him. Earthworms are vegetable feeders exclusively. In burrowing the worms take more or less earth into the alimentary canal, where it is mixed with the vegetable food of the worm, and nearly all of it passes out with the castings, which are always voided on the surface. These castings are therefore a sort of natural compost, which the earthworms are continually distributing over the surface of the areas which they inhabit. They are thus not only constantly transforming vegetable matter into more usable forms, but are also so mixing it with inorganic matter as to make both of greater use. Such a process is called the formation of vegetable mold, and it is continually going on wherever the conditions are suitable. It is not of course confined to the agency of earthworms, though Mr. Darwin showed that they were one of the most important agents. The rate at which vegetable mold may be formed by these worms will vary of course with the character of the soil, the number of worms, and the abundance of food, but under favorable conditions it may be several inches in a century. Such soil is fertile not alone because of its composition, but because the movements of the worms keep it stirred up and well aerated. For further particulars in reference to the habits and usefulness of earthworms, consult Darwin, *The Formation of Vegetable Mould through the Action of Worms* (London, 1881).

**Structure.** Earthworms are generally of a uniform color, although there is a difference in shading between the upper and under surfaces and between different regions of the body. The color is usually flesh red, varying into dull pink on the one hand and dirty brown on the other. In size there is great diversity, some species reaching a length of only a few inches, while tropical species may be several feet in length. Large specimens of the common American species are rarely a foot long. In such specimens as many as 180 segments may be present, but 130 is about the average number. The muscular system of earthworms is well developed, and consists of an outer series of circular or transverse muscle fibres which girdle the body, and an inner series of longitudinal fibres which form five principal bands, and several smaller ones concerned with the movements of the setæ. The nervous system consists of a large ganglion above the œsophagus, often called the brain, and a ventral cord, which lies beneath the alimentary canal, and bears ganglia in every segment. This cord is connected with the brain by commis-



STRUCTURE OF AN EARTHWORM.

1. An entire worm, side view; 1, 1st segment and mouth; 15, 15th segment, showing opening of male genital ducts; 33, 33d segment and thickened clitellum. 2. Anterior portion of *Lumbricus terrestris*, laid open and enlarged; o, mouth; p, pharynx; g, gizzard; m, œsophageal glands; c, proventriculus; s, gizzard; i, intestine; h, one of the "hearts" borne on the side of the dorsal vessel; t, seminal reservoirs; sp, spermatheca. (After Lankester.)

sures around the œsophagus. So far as known, there are no sense organs other than those of touch. The alimentary canal consists of a muscular pharynx, a slender œsophagus, a muscular gizzard and thin-walled crop, and a long, straight intestine, within which is a complex dorsal fold, to increase the digestive surface. The circulatory system is well developed and consists of a prominent dorsal blood vessel and no less than four ventral vessels, which run longitudinally in the body and are connected with each other by a regularly arranged series of transverse vessels, many of which form a network of capillaries in the muscles and in the wall of the intestine. In some of the anterior segments some of these transverse vessels are much larger than elsewhere and form very prominent arches, often called "hearts," of which there are usually five pairs. They are not functionally "hearts," however, or at least only in part, for most of the pumping is done by the dorsal trunk and general muscular movements. Excretion takes place through the very characteristic nephridia, of which there are a pair in each segment, one on each side of the intestine.

They consist of coiled tubes, having at one end a funnel-shaped opening into the body cavity, while the other end opens outside of the body. The funnel always opens into the segment just anterior to that in which the tube itself lies.

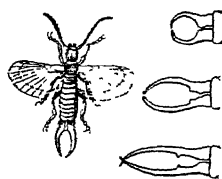
**Reproduction.** Earthworms are hermaphroditic—that is, both male and female reproductive organs occur in the same individual. But mutual cross-fertilization probably always takes place. The eggs are laid in capsules which are buried in the earth and serve to protect the young until they are well developed. These capsules are probably formed from the secretion of the *clitellum*, a peculiar part of the body wall, between the 29th and 35th segments. The clitellum is generally a very prominent band, forming one of the most noticeable of the external features of an earthworm, but it is not always evident. The eggs of earthworms contain considerable yolk, and the young worms develop without any metamorphosis.

Consult: S. A. Mearns and Wilson, *General Biology* (New York, 1915); Beddard, "Earthworms and Leeches," in *Cambridge Natural History*, vol. ii (New York, 1896); id., *Earthworms and their Allies* (New York, 1912).

**EAR TRUMPET.** A contrivance for improving the hearing of the partially deaf, and, as its name implies, a trumpet-shaped tube, whose action depends on the principles of reflection. The waves of sound strike the bell of the trumpet and are reflected into the narrower portion of the tube. As the waves proceed, the wave front narrows in breadth, but increases in intensity and the sound reaches the inner ear magnified. In a great number of cases of impaired hearing, there can be no doubt that much assistance is obtained from the use of the ear trumpet; still it must not be used indiscriminately, for in unsuitable cases it may do much mischief, both in increasing the deafness and aggravating the noises in the head from which deaf persons often suffer so much. It also possesses the great disadvantage of magnifying certain sounds at the expense of others. The ear trumpet, on account of its shape, acts as a resonator, and will strengthen and increase the vibrations of certain frequencies, while others will be almost destroyed. Ear trumpets are of most use, perhaps, in advanced cases of nervous deafness, though injurious in the early stages of this complaint; they are hurtful also in all acute diseases of the ear, and of little or no use in those cases of great thickening of the contents of the middle ear, where the adapting power of the organ has been lost. Most of the small and so-called invisible ear trumpets are considered practically useless. All of the useful instruments have good-sized bowls, which in some cases rest against the temple when inserted in the ear, thus aiding the hearing by bone conduction. Another variety, applicable to the more severe cases of deafness, consists of an elastic tube, one end of which is tipped with ivory and is placed in the ear of the patient; the other is held in the hand of the speaker, who applies his mouth to the open extremity. Ear trumpets are generally made of some thin metallic substance, such as tin. Gutta-percha and other substances are also frequently used. Various modifications of the telephone are now employed to reinforce the sound waves and transmit them to the ear. See AUDIPHONE.

**EAR WAX.** See CERUMEN.

**EARWIG** (AS. *ēarwīga*, from *ēare*, Eng. *ear* + *wīga*, insect; connected with AS. *wīg*, horse, *wiht*, wight, from *wegan*, Icel. *vega*, Goth. *gawigan*, OHG., Ger. *wegan*, to carry, move; connected with Lat. *vehere*, OChurch Slav. *vešti*, Skt. *rah*, to carry, Gk. *ἔχειν*, *echēin*, to hold). A popular name for orthopterous insects of the family



AN EARWIG.

The three outline figures above show the extensive variability of the "tail-like processes" of the male of a single species (*Forficula auricularia*).

Forficulidæ, resembling rove beetles, but easily distinguished from them by the presence of pincer-like processes at the posterior end of the abdomen. They probably owe their name to the foolish belief that they creep into the ears of sleepers. Earwigs are common in the United States only in the Southern States and on the Pacific coast. They are fond of moist situations, such as under the decayed bark of trees, under stones, among old straw, etc. They are nocturnal in habit, and while their food is chiefly vegetable, such as flowers and ripe fruit, they probably do much good by destroying numbers of thrips, aphids, etc. The name is also applied in the United States to several small centipedes which frequent houses.

**Fossil Earwigs.** The earliest-known ancestor of the earwigs, a fossil genus (*Baseopsis*) from the Liassic rocks of Schambelen, Switzerland, is considered an interesting link connecting the Orthoptera and Coleoptera. Another Mesozoic genus is known in the Solenhofen limestones of Bavaria. Tertiary earwigs have been found in the amber of northeastern Prussia, in the beds of Aix, France, and Oeningen, Germany, and 11 species are known in the Oligocene shales of Florissant, Colo. These latter include some very large species with unusually large eyes. See ORTHOPTERA.

See bibliography under ORTHOPTERA; also de Bormans and Krauss, "Forficulidæ and Hemimeridæ," in *Das Tierreich*, ii. Lieferung (Berlin, 1900).

**EAR WORM.** The bollworm (q.v.). Also the cotton worm. See COTTON INSECTS.

**EASEL** (Dutch *ezel*, OHG. *esil*, Ger. *Esel*, Goth. *asilus*, AS. *esol*, *eosol*, from Lat. *asinus*, ass). A wooden structure, usually of tripodal form, upon which an artist places his canvas or panels when painting. The canvas is placed at a convenient height by means of pegs upon which is set a tray or supporting board, holes being bored in the two forward legs of the structure at regular intervals for receiving these pegs. This is the easel still in common use, though perhaps of earliest invention. Other forms of the easel, more mechanical in contrivance, are employed for large canvases.

**EASEMENT.** An acquired right of use or enjoyment in the lands of another, which one may have by virtue of his ownership or possession of other land. Though limited in number, easements are of very frequent occurrence, and comprehend such well-known rights as rights of way, of light, of drainage, and the like. They belong to that large class of rights, falling short of ownership, in the lands of others (*jura in re aliena*), which, from the point of view of the land subjected to the use, are sometimes called servitudes. The Roman law distinguished two

classes of servitude, urban and rural, and developed a refined and highly elaborated body of rules to determine the conflicting rights of the owner of the burdened land and of the person entitled to the use thereof. (See SERVITUDE.) In the common-law classification of property rights, easements belong to the class of incorporeal hereditaments, so called because they do not involve the possession of the land in which they are exercisable, as distinguished from the direct ownership coupled with the possession of a parcel of land, and because, like other real-property rights, they are inheritable with the lands to which they are appurtenant. They are limited in our system to real property, though the Roman law recognized servitudes in chattels, or movables, as well as immovables.

Though sometimes improperly used so as to include several varieties of rights in *alieno solo*, the easement proper is to be sharply distinguished: (1) from rights not acquired, but which flow directly from, and inhere in, the ownership of land, as the right to the uninterrupted flow of water in a watercourse, the right to the support of land in its natural state, etc., which are properly denominated *natural rights*; (2) from rights which do not consist in mere use, but which extend to the taking of something of value from another's land, as the right of pasturing cattle thereon, the right to mine coal or other minerals therein, and the like, which are known as *profits à prendre*, or, more briefly, as profits; (3) from rights of use which attach to a person as an individual and not as a property owner, and which are commonly spoken of as easements *in gross* as distinguished from easements *appurtenant*, but which are, strictly speaking, only *licenses* to use the land of another and not, therefore, inheritable or transferable as property rights (except in a few of the United States, where easements in gross have come to be recognized as property and as imposing a burden or servitude running with the land over which they are exercisable); and (4) from rights of use which pertain to one as a member of the public, such as the right to use a highway on another's land or to use a private stream for purposes of navigation, and which are sometimes improperly called public easements. See NATURAL RIGHTS; PROFIT; LICENSE.

As thus limited and defined, the term easement commonly describes only such a right of use as is appurtenant to a specific parcel of land to whose value and enjoyment it contributes. The right is, in fact, conceived of as belonging to the land, rather than to the owner thereof for the time being, and as burdening the land over which it may be exercised, and not the person having the actual possession thereof. Accordingly, the estate to which the right attaches is known as the dominant tenement, and the estate subject to the servitude as the servient tenement. It follows, also, that the easement is unaffected by any disposition which may be made of either estate. The servient estate is subject to it, into whosoever hands it may come, and the right of use passes with the dominant tenement, whenever that is conveyed. It was formerly considered that it was necessary to make some reference to the incorporeal rights attaching to an estate, at the time of conveying it, in order that these might pass with it to the grantee, and hence the use of the phrase "with the appurtenances" in modern deeds; but it has long been settled that these or any other



apt words are wholly unnecessary to produce that effect.

Easements are classified at common law as *positive* (or *affirmative*) and *negative*, the former having reference to such as involved the physical use of another's land by going upon it or otherwise, as a right of way or of drainage; while the latter, as in the right to light (see LIGHT, EASEMENT OF) or to the support of a party wall, calls for no such physical encroachment. While convenient for some purposes, this distinction is superficial and has no real significance, the duty of the owner of the servient tenement being in all cases purely negative—to refrain from so using his land as to interfere with the rights of the dominant tenement—and involving no obligation to repair or do any other affirmative act.

The infringement of an easement is commonly a nuisance, and may accordingly be abated, either by act of the party injured or by appropriate legal proceedings (see NUISANCE); and if the infringement be only threatened, or if the common-law remedy be inadequate to redress the injury committed, an injunction may be granted to restrain the acts complained of. (See INJUNCTION; TORT.) But an easement is a true property right, or right in rem, and is protected not only against the acts of the owner or possessor of the servient tenement, but against those of any person whatsoever, the same remedies being available in the one case as in the other. Where a right in the nature of an easement exists which is not thus protected, such as might arise by contract between two adjoining landowners, this is a mere right in personam, a license, and not an easement or a property right at all. A contract, however formal, can never create a legal interest in land, though it may under certain circumstances give rise to an action against the owner of the land as such or to a proceeding in equity restraining him from using his land in violation of his agreement.

Easements may arise in three ways, the second and third of which are, by a legal fiction, mere forms or variations of the first. These are: (1) grant, or deed; (2) prescription; and (3) implication. The deed of grant has from the earliest period of the common law been the peculiar and appropriate instrument for the creation and transfer of an incorporeal interest in land, corporeal interests, such as freehold estates, being formerly conveyed only by the process known as livery of seisin, i.e., by an actual physical transfer of possession. By prescription is meant open and uninterrupted use and enjoyment from time immemorial, which, in the view of the law, created a presumption of a grant of the right claimed at some remote period of time. Formerly this presumption could be shown to be unfounded and the claim thus defeated, but in the United States, and for most purposes in England, the presumption of a lost grant, as it is termed, is a pure fiction, and is no longer requisite to establish an easement by prescription. Easements by implication are such as arise from a legal presumption of the intention of the parties at the time a parcel of land is conveyed. Perhaps the best illustration of such an easement is what is known as a "way of necessity," which exists where one buys premises which are shut off on all sides by intervening land from access to the highway. Here the easement arises, not from the necessity

of the case, but from a reasonable presumption that the grantor of the landlocked parcel intended to give with it a right of way over his remaining land.

Of these several ways of creating easements, the first is the most comprehensive. All easements may arise by grant, and some only in that way. In the United States it is generally considered that negative easements, such as the easements of light, of lateral support, and the like, cannot exist by prescription, though the contrary view is taken in England and in a few of our States. On the other hand, only a few classes of easements will arise by implication—such, that is to say, as involve a "continuous and apparent" user of the premises affected, as an aqueduct or drain. There is much difference of opinion as to what easements are properly to be described as continuous and apparent, negative easements being included in some jurisdictions and excluded in others, and the decision being sometimes made to turn on the question whether a permanent structure, like a drain, was actually apparent and known to the parties at the time of the conveyance.

Easements may be lost or destroyed, either by release, by merger, by abandonment, by license, or, in some cases, by destruction of the premises to which they attach. Merger occurs where the dominant and the servient estates become vested in the same person. Here the easement will not revive upon the subsequent conveyance of either of the estates to another person. It is not true, as is often said, that an easement may be lost by mere nonuser. But if the nonuser be under such circumstances as to show an intention to abandon the easement, it may be lost through the act of the servient tenant in accepting the abandonment by obstructing the easement. So where the dominant tenant licenses the owner of the servient estate to plow up a way or obstruct the former's light, the license, once acted upon, is irrevocable and the easement at an end. Mere misuse of an easement is as inoperative to destroy it as nonuser. Such a right must be exercised within narrow limits, however: nothing may be done by the dominant tenant which materially increases the burden upon the servient tenement; neither may he make any material change in the manner of exercising it; but the remedy for an excessive user of an easement is an action of trespass and not the forfeiture of the right which has been abused. It is not, however, an unlawful or excessive user of an easement to enter upon the servient premises from time to time for the purpose of repair and of keeping the easement in good working order, nor for the purpose of abating a nuisance which interferes with its enjoyment.

It is only where an easement is of an ephemeral or temporary character that it is lost by any injury to the premises. The destruction of a road by flood or earthquake does not affect the right of way which exists with reference to it. The person claiming the easement may, at his own cost, make whatever repairs are necessary to restore the way to its former condition. So, if a house having an easement of light be destroyed by fire, the easement is not lost, but revives on the rebuilding of the house. But easements of lateral support, such as those which attach to party walls, are manifestly intended only for the houses which are supported by such walls, and the complete destruction of



the premises has the effect of destroying the easements on both sides. Either party may thereupon rebuild on his own land at his own pleasure and without reference to his neighbor. However, if the party wall is not completely destroyed, but is susceptible of repair or reconstruction, it may be restored by the party desiring to avail himself of the easement, at his own expense, and his right to the support of the wall continues as before.

The narrow range of the class of rights under consideration, the restrictions which the law imposes upon their creation and exercise, have been made clear by the foregoing explanation of their legal character and status. This jealous attitude of the law towards rights of this character is due to the fact that they always constitute an interference with the free exercise of his natural rights by the owner of the servient tenement. The easy creation and the indefinite multiplication of such rights would produce grave inconvenience and would seriously hamper the free alienation of real property. Hence the common law has still further restricted them by arbitrarily limiting their number. It is a maxim of the law that no novel easements can be created. Landowners are limited to the kinds which have always been known, and which have previously been recognized by the courts as proper and convenient burdens upon land. Those already referred to—ways, lights, drains, water-course, support to buildings—comprehend practically all, or nearly all, such rights as can be created. Attempts have been made to increase the number, but the courts have invariably refused to countenance such proposed additions to the list, as the right of access of wind to a windmill or a chimney, the right to an unobstructed view, etc. Such a right may, indeed, be conferred upon one man by another, but it remains a mere right in personam, a contract right, and does not become a burden upon the land of the grantor or an appurtenance to the estate of the grantee. The only exception to this principle is that furnished by the case of the "equitable easement," whereby a restrictive covenant affecting the use of land—as an agreement not to build within a certain distance of the street line—is enforceable in equity—not only against the maker of the covenant and his heirs, but also against his assigns who take title with notice of the understanding. But even this exception, important though it be, is usually limited to a narrow range of cases, in which the covenant sought to be enforced is purely restrictive in character and imposes no active duty upon the owner of the premises affected. See **EQUITABLE EASEMENT**.

Analogous to easements in their effects, but differing fundamentally from them in character, are the rights which are loosely described as "covenants running with the land." It has already been stated that an easement cannot be created by covenant—which is only a contract under seal—but requires the ancient form of a grant. Interests, or estates, in real property, whether corporeal or incorporeal, are too important to be subject to creation or transfer by any but the most solemn legal forms. Hence a contract, affecting the use of land, like any other contract, creates only a right in personam, a right of action on contract, and not an interest in the property itself. But if such right of action runs with the land, that is, if it binds anybody and everybody, who becomes the owner

of the land, and if, on the other hand, it is enforceable, not only by the person to whom the promise is made, but by everybody who becomes entitled to the promisee's land, it is evident that we have the substance if not the form of an easement. The method of enforcing the right is different, by an action in covenant instead of trespass; but the right, on the one hand, and the burden, on the other, are not otherwise distinguishable from those resulting from an easement. In a very limited class of cases, such rights, arising out of covenant, are recognized in our law. The essential conditions are: (1) that the covenant shall "touch and concern" the land, that is, that it shall affect the use and condition of the premises; and (2) that there shall be privity of estate, that is, some such relation as that of landlord and tenant, between the parties. In other words, both parties must in a legal sense have an interest or estate in the parcel of land affected by the covenant. Thus, if a tenant covenants to make repairs, or to cultivate the land in a certain way, the right to enforce such covenant will pass to the landlord's assignee, and the same form it will be equally incumbent upon the assignee as upon the original tenant who entered into the covenant. In a few American jurisdictions this principle has been extended to the case of the privity existing between the owners of a dominant and a servient tenement, respectively, so that a covenant by the latter to keep a private way over his land in repair for the benefit of the former would pass as a permanent burden with the land; but this extension of the common-law doctrine is not generally accepted in the United States nor in England.

There is, of course, no element of easement in the other class of cases to which the expression "covenant running with the land" is applied—those, namely, where, there being no relation of privity of estate, a covenant for the benefit of a parcel of land, by whomsoever made, is enforceable by those to whom the land may pass by descent or otherwise, against the covenanting party. Here we have the exact reverse of what is erroneously termed an easement in gross—the latter being a right in land claimed by an individual in his personal capacity, and the former a right vested in the land, or in its tenant for the time being, against an individual. There being no servitude, there is no easement, which, as has been said before, requires both a dominant and a servient tenement. See **INCORPORALED; HEREDITAMENT**.

The authorities are modern, the law on the subjects of easements being of a very meagre character prior to the nineteenth century. Consult: Holland, *The Elements of Jurisprudence* (9th ed., New York and Oxford, 1900); Gale, *Easements* (7th ed., London, 1899: 8th ed., Toronto, 1908); Goddard, *Easements* (6th ed., London, 1906); Washburn, *Easements* (6th ed., Boston, 1885); Jones, *Treatise on the Law of Easements* (Boston, 1898); Inness, *Law of Easements* (8th ed., London, 1911).

**EASLEY.** A city in Pickens Co., S. C., 12 miles west of Greenville, on the Pickens and the Southern railroads (Map: South Carolina, B 2). It is in a fertile cotton region and has cotton, oil, and flour mills. Pop., 1900, 903; 1910, 2983.

**EAST, SIR ALFRED** (1849-1913). An English landscape painter and etcher. He was born at Kettering, and studied at the Glasgow Art

School, at the Ecole des Beaux-Arts, Paris, and under Fleury and Bouguereau. He painted usually in a low key, with great breadth and freedom of handling, and sought to render effects of light and color rather than definite line. His art is a direct interpretation of nature, possessing a strong lyrical quality and revealing a subtle personality. His water colors are forceful yet delicate in treatment, and his etchings are spontaneous and original. He best interpreted English landscape, but displayed his versatility in studies of America and of Japan, which he visited in 1889. East was elected president of the Royal Society of British Artists in 1906, a member of the Royal Academy in 1913, and was knighted in 1910. He was honorary member of the Japanese Meiji Bijutsu Kai and of the academies of Rome, Milan, and Stockholm, and received many medals and honors. His works were frequently exhibited in Europe and America. Among his paintings in public collections are: "Evening in the Catswolds", "A Passing Storm" (Luxembourg); "Haunt of Ancient Peace" (Budapest); "The Nene Valley" (Venice); "London at Night" (Milan); "Returning from Church" (Carnegie Gallery, Pittsburgh); "Moon" (Chicago); "Autumn" (Manchester). He was the author of *The Art of Landscape Painting in Oil Color* (1906).

**EAST AFRICA COMPANY, BRITISH.** A commercial association, founded after the Berlin Treaty of 1885, to develop African trade in the territory controlled by the English.

**EAST AFRICA COMPANY, GERMAN.** A trading company, formed in 1885, to develop the African territory under German influence.

**EAST AFRICA PROTECTORATE.** A British dependency extending from German East Africa to Italian Somaliland and Abyssinia, and from the Indian Ocean inland to Uganda (Map: Africa, H 4). It includes seven provinces (each under a provincial commissioner) and a tract of territory in the northwest partly organized; together with certain territories leased from the Sultan of Zanzibar (a 10-mile-wide strip along the coast from the German frontier to Kipini, the islands of the Lamu Archipelago, and a 10-mile tract surrounding Kismayu) at an annual rental of £17,000. The area of the protectorate is estimated at 250,000 square miles. The coastal districts are fertile and enjoy a climate healthful in comparison with that of other tropical regions; and here are grown rice and other cereals, coconuts, cotton, sisal, rubber, and tobacco. The central highlands have a temperate climate and produce in export quantities potatoes, fruits, sim sim, and beans; other cultivated products are coffee, wheat, and barley. Stock raising is a growing industry, the extensive upland pastures furnishing grazing for cattle, sheep, and ostriches. In the south great tracts of high-growing grasses give cover to herds of wild beasts. The Ukamba and Nairasha provinces are the most suitable for European colonization. From the highland forests come croton, olives, figs, and timber; the coast regions yield rubber, gum copal, mangroves, and timber; while in the interior lowlands are found acacia and ebony. No exact information exists concerning the country's mineral resources in detail: iron is generally distributed; in Ukamba, carbonate of soda, mica diatomite, and graphite are found; opals are present in the valley of the Rift; limestone is worked, but gold mining

has ceased. The disposal of land in 1911 was as follows: 4941 acres freehold (6216 in 1910; 10,348 in 1909; 32,795 in 1907), 603,811 lease (383,382; 363,222; 538,573). Of the total 7370 were agricultural (19,852; 18,394; 26,126) and 601,382 grazing (369,746; 350,575; 327,939). The growth of the trade is seen in the table below:

YEARS	Imports*	Exports	Customs
1903-04	£436,947	£159,815	£33,159
1905-06	672,360	332,838	78,718
1907-08	799,717	515,052	81,655
1909-10	775,246	590,057	84,289
1910-11	1,000,346†	962,911	99,508
1911-12	1,330,437	1,016,898	122,940
1912-13	1,808,343	1,203,201	

\* Exclusive of railway material, administration stores, and specie.  
† Including £66,382 for material for the Magadi Railway.

Shipping entered and cleared: 2,886,331 tons in 1911-12; 2,566,731 in 1910-11; 1,762,243 in 1908-09. The protectorate government operates the Uganda (Mombasa-Victoria) Railway; length, 586 miles. The cost of construction, to March 31, 1912, was £5,734,335. In connection with the railway, four steamers are operated on the lake. The revenue is derived from customs, port, harbor, etc., dues, licenses and taxes, court fees, posts, telegraphs, and railways, etc., and amounted in 1912-13 to £729,078. The expenditure was for the same year £961,178, and the grant in aid, in 1911-12, £115,000. The Treasury advanced £250,000 in 1911 and £375,000 in 1912 for public works, and in 1912 the grant in aid was suspended.

For a brief period the protectorate was, with Uganda, administered by the Imperial British East Africa Company, the original grantee; but in 1895 it was transferred to a commissioner and commander in chief under the Foreign Office. In 1905 it was again transferred from the control of the Foreign Office to that of the Colonial Office. In 1906 an order in council constituted the administrator a governor and provided for executive and legislative councils. Lieut. Col. J. Hayes Sadler was the first governor and commander in chief. Nairobi is the administrative headquarters and the central station on the Uganda Railway, with 14,000 inhabitants (700 Europeans). The largest town and chief port is Mombasa, with about 30,000 inhabitants (230 Europeans). Kilindini possesses the finest harbor on the east coast and is to have extensive improvements. A recent estimate gives 4,038,000 for the population. The coastal population is largely Mohammedan; in the interior pagan, Bantu-speaking tribes predominate; other non-Bantu tribes are the Masai, the Somalis, and the Gallas. Consult: Purvis, *Handbook of British East Africa and Uganda* (London, 1900); *British Empire Series* (ib., 1899); *The Rise of our East African Empire* (ib., 1893); Lugard, *British East Africa and Uganda* (ib., 1892); Eliot, *East Africa Protectorate* (ib., 1905). Consult also the publications of the Colonial Office of Great Britain.

**EAST ANGLIA**, an'gli-ā. See **ANGLIA, EAST**.

**EAST AURORA.** A village in Erie Co., N. Y., 17 miles southeast of Buffalo, on the Pennsylvania Railroad (Map: New York, B 5). It is noteworthy as the home of the Roycrofters, whose shop produces fine handmade furniture

and editions de luxe of current and standard books. There are also roller mills and agricultural-implement works. The village contains a covered mile race track and mineral springs. The water works and sewerage plant are owned by the municipality. Pop., 1900, 2366; 1905, 2448; 1910, 2784.

**EASTBOURNE**, *ĕst'bôrn*. A county borough and seaside resort in Sussex, England, situated on the coast between Hastings and Brighton, about 3 miles northeast of Beachy Head (Map: England, G 6). It is well built, with broad, tree-lined streets, lighted by electricity. A fine esplanade nearly 3 miles long skirts the shore. Devonshire Park (13 acres) and numerous smaller recreation grounds are maintained by the municipality. The town hall, erected in 1886, is a handsome building. Eastbourne was incorporated in 1883 and in 1911 was made a county borough. The borough owns its electric-lighting plant, motor-omnibus lines, isolation hospital, technical institute, etc. It has established an excellent system of drainage and a good water supply from wells, all of which, combined with its healthful situation, have made it one of the most popular of south-coast resorts. Pop., 1901, 43,574; 1911, 52,544.

**EAST BRIDGEWATER**. A town in Plymouth Co., Mass., 24 miles south of Boston, on the New York, New Haven, and Hartford Railroad (Map: Massachusetts, F 4). The chief industries comprise an iron foundry and a cotton gin. Pop., 1900, 3025; 1910, 3363.

**EAST CAPE**. The name of the easternmost headland of Asia (coast of Siberia). It is situated in lat. 66° 3' N. and long. 169° 44' W. and is separated by Bering Strait from Cape Prince of Wales in America (Map: Asia, R 2).

**EASTCHEAP** (*ME. Estchepe*, east market, from *AS. east*, east + *cēap*, traffic). Originally an open space in which a market was held for the East of London. It was situated at the junction of several streets, the oldest and most important of which were the two great Roman roads, leading northwest and northeast out of London. These roads were known in Saxon times as Watling and Ermine streets and met on the north side of London Bridge. On account of its situation on these roads Eastcheap was famous at a very early date for its taverns; and the "Boar's Head at Eastcheap," of Shakespeare's Prince Hal and Falstaff, was probably thus known as early as the reign of Edward III. The name is still preserved in that of a small street, near the north end of London Bridge.

**EAST CHICAGO**. A city in Lake Co., Ind., 22 miles by rail southeast of Chicago, on the Pennsylvania, the Wabash, the Pere Marquette, the Baltimore and Ohio, Chicago Terminal, the Chicago, Indiana, and Southern, and the Indian Harbor Belt railroads, and on Lake Michigan (Map: Indiana, B 1). The chief industries are the manufacture of iron and steel, cement, lumber, boilers, hay presses, chains, chemicals, and foundry products. East Chicago has a good harbor, and its shipping facilities have been greatly enhanced by the construction of a canal, connecting the harbor with the Calumet River. Bascule bridges and turning basins have been provided. The city is governed by a mayor and a unicameral council of six members. East Chicago was incorporated as a town in 1889 and as a city in 1893. Since then its growth has been very rapid. Pop., 1900, 3411; 1910, 19,098; 1914 (U. S. est.), 25,781.

**EAST CLEVELAND**. A city in Cuyahoga Co., Ohio, 5 miles east of Cleveland (Map: Ohio, G 2). It has laboratories of the National Electric Lamp Associations. The city is essentially a residential suburb of Cleveland and contains the beautiful summer estate of John D. Rockefeller, covering more than 700 acres. Pop., 1900, 2737; 1905, 9179; 1914 (U. S. est.), 11,914.

**EAST CONEMAUGH**, *kōn'ĕ-mā'*. A borough in Cambria County, 32 miles (direct) southwest of Altoona, on the Pennsylvania Railroad, and on the Conemaugh River (Map: Pennsylvania, D 6). The chief industry is the manufacture of steel. Conemaugh contains railway shops and owns its electric-light plant. The borough was partially destroyed by the Johnstown flood in 1889. Pop., 1900, 778; 1910, 1549.

**EAST END**. A thickly populated and poor district of London, east of the Bank of England.

**EAST END**. In architecture, the altar end or chancel end of a church, as opposed to the west front or entrance end. It has been the nearly universal practice ever since the fifth century to orient the church building so that the priest at the altar and the congregation may both face the east in worship. In the earliest churches, as in pagan temples, the entrance was in the east end, and the officiating priest faced the worshippers. This orientation (q.v.) was preserved in St. Peter's at Rome, but was generally given up at an early date in favor of the present practice. The architectural treatment of the east end is a characteristic mark of various styles. Except in many English cathedrals and churches, and Cistercian churches elsewhere which have square east ends, the central aisle of the chancel generally terminates eastward in an apse, with or without an ambulatory, apsidal chapels, etc. See **EAST WINDOW**; **APSE**; **CHURCH**; **CHANCEL**; **GOTHIC ARCHITECTURE**; **ORIENTATION**.

**EASTER** (*AS. ēastre*, OHG. *ĕstarā*, Ger. *Ostern*, from Teut. *Austrō*, goddess of spring; connected with Lat. *aurora*, Gk. *ἠώς*, *ēōs*, with *AS. east*, and ultimately with Gk. *ἡμαρ*, *hēmar*, day, Lat. *ver*, spring). The festival of the resurrection of Christ, the principal feast of the Christian era. From very early Christian times it was observed with great solemnity. In the primitive Church it was one of the special days for the administration of baptism, and the Latin name of the octave or the Sunday following, *Dominica in Albis*, preserves the memory of the custom of the newly baptized wearing their white robes throughout the whole week. The faithful greeted each other with the kiss of peace and the salutation "Christ is risen," to which the response was, "He is risen, indeed." This custom is still kept up in Russia. In the Catholic church the festivities of Easter really begin on the preceding morning with the mass of Holy Saturday, in which the short first vespers of Easter are included—a trace of the times of primitive severity, when the mass of that day was celebrated in the evening.

The proper time for the celebration of Easter has occasioned much controversy. In the second century a dispute arose on this point between the Eastern and Western churches. The great mass of the Eastern Christians celebrated Easter on the Jewish Passover, the fourteenth day of the first Jewish month or moon, thinking of Christ as the true Paschal Lamb. The Western churches celebrated it on the Sunday after the fourteenth day, holding that it was the commemoration of

the resurrection of Jesus. The Council of Nicæa (in 325) decided in favor of the Western usage, Easter with the name of the heresy. This, however, only settled the point that Easter was to be held, not upon a certain day of the month or moon, but on a Sunday. The proper astronomical cycle for calculating the occurrence of the Easter moon was not determined by this council. It appears, however, that the metonic cycle (q.v.) was already in use in the West for this purpose; and it was on this cycle that the Gregorian calendar, introduced in 1582, was arranged. The time of Easter, being the most important of all the movable feasts of the Christian Church, determines all the rest. It was debated, at the time of the introduction of the Gregorian calendar, whether Easter should continue to be movable, or whether a fixed Sunday, after the 21st of March, should not be adopted. It was deference to ancient custom that led the ecclesiastical authorities to adhere to the method of determination by the moon. It must be remembered, however, that it is not the actual moon in the heavens, nor even the mean moon of astronomers, that regulates the time of Easter, but an altogether imaginary moon, whose periods are so contrived that the new (calendar) moon always follows the real new moon (sometimes by two, or even three, days). The effect of this is that the fourteenth of the calendar moon—which had from the times of Jewish law been considered the "full moon" for ecclesiastical purposes—falls generally on the fifteenth or sixteenth of the real moon, and thus after the real full moon, which is generally on the fourteenth or fifteenth day. With this explanation, then, of what is meant by full moon, viz., that it is the fourteenth day of the calendar moon, the rule is that Easter Day is always the first Sunday after the paschal full moon, i.e., the full moon which happens upon or next after the 21st of March (the beginning of the ecclesiastical year); and if the full moon happens upon a Sunday, Easter Day is the Sunday after. The adoption of the Gregorian calendar (see CALENDAR) changed the date of Easter. The Greek church, which did not accept the Gregorian calendar, therefore usually celebrates Easter on a different day from the Western church.

One object in arranging the calendar moon was that Easter might never fall on the same day as the Jewish Passover. They did occur together, however, in 1805, in 1825, and in 1903, on the 12th of April, and will do so again in 1923 on the 1st of April, in 1927 on the 17th of April, and in 1981 on the 19th of April. The Jewish Passover usually occurs in the week before Easter, and never before the 26th of March or after the 25th of April. On the other hand, the Christian festival is never before the 22d of March or after the 25th of April. In 1761 and 1818 Easter fell on the 22d of March, but this will not be the case in any year of the twentieth century. The latest Easter in this century occurs in 1943, on the 25th of April.

The popular observances, past and present, connected with the day are innumerable. The use of eggs in this connection is of the highest antiquity, the egg having been considered in widely separated pre-Christian mythologies as a symbol of resurrection. It is probable that here, as in other cases, the Church adopted and consecrated an earlier custom. This is certainly true of the Easter fires which formerly celebrated the

triumph of spring over winter. (See BELTANE.) Some of the mediæval customs, especially in France and Germany, were very quaint—e.g., that which prevailed in several French cathedrals of a solemn game of ball played by the bishops, canons, and other dignitaries (described by Pater in one of his *Imaginary Portraits*); grave and rhythmical dances were performed at Auxerre as late as the fifteenth century and at Besançon as late as the seventeenth century, to the strains of the Easter sequence, *Victimæ paschali*. All these observances had a common purpose, the expression of joy in the resurrection. To the popular sports and dances (still maintained in some places, as at Constantinople, where the whole Greek colony celebrates the festival with the ordinary accompaniments of a fair in the cemetery of Pera) were added farcical exhibitions, in which even the clergy joined in some places, reciting from the pulpit stories and legends calculated to excite laughter (*risus paschalis*) among the hearers. Easter customs form an excellent illustration of popular survivals in religion.

**EASTER ISLAND** (so called because discovered by Roggeveen on Easter, April 6, 1722). There is reason to identify this island with a discovery made by Davis the buccaneer in 1686, and the Spanish geographers assign the credit to Alvaro Mendaña in 1566. The island has no name in the language of its inhabitants; Forster's name, *Vaihu*, is the name of a landing place on the south shore; Cook's *Teapy* means no more than gorge and was of local application to a narrow way; *Rapanui* is a modern invention; *Te Pito te Henua* is merely any one of its three corner capes. It is the most eastern site of Polynesian habitation and lies in lat. 27° 20' S. and long. 109° 30' W. (Map: Western Hemisphere, M 10). The island, triangular in shape, is a volcanic formation, with typical craters at each apex of the triangle, and reaches a height of 1200 feet, but there is no evidence of present volcanism. The area is about 45 square miles, the soil thin and poor, water almost absent, timber scanty and not higher than bushes. The island was almost depopulated by vessels in the Chilean labor trade which carried away the men to work on the Chincha Islands; at present not more than 150 survive on Easter Island. The island has been an unorganized dependency of Chile since 1888. The particular interest which attaches to Easter Island is dual: it is the richest site of the megaliths of the Pacific; it is the unique source of incised tablets or hyloglyphs in the island realm.

The megaliths of Easter Island occur in three forms, all cyclopean. Upon the bluffs and in other sites commanding a view of the sea great platforms have been built, with neatly fitted facing stones set without mortar and the inner area filled with rubble. In the survey conducted by officers of the U.S.S. *Mohican* 113 such platforms have been measured, each known by name to the older inhabitants. The largest platform is known as *Tongariki*, 150 feet long, 9 feet wide, 8 feet high, original extent, with wing annexes, 540 feet. Into the construction of the platform known as *Ohau* entered a stone weighing six tons; the platform *Anaoraka* shows the largest stones, one on the sea face measuring on its exposed surface 6 feet, 9 inches high and 4 feet, 7 inches wide. In the neighborhood of many of the platforms are

found semisubterranean inclosures, conveniently called houses, although their purpose is unknown. These are built of great stones artfully fitted and in many instances are decorated with pictographs, either colored by rubbing with tufa and shell or incised, or both. Many of the designs are identical with figures on the hyloglyphs; for this reason the mural painting may be considered modern, though older than present memory. The most conspicuous units of all this stonework are the statues rudely carved after the manner of terminalia—a head with exaggerated ears, a neck and shoulders. The *Mohican* survey discovered 555 statues; the largest measures 70 feet in length and lies unfinished in the quarry at Rano Karaka; the largest which has been put in position on a platform is 32 feet long and weighs 50 tons. The material of the statues is gray trachytic lava. Upon the head of each statue when erected upon the platforms was set a cylinder of red vesicular tufa of an average weight of three tons, the largest one measuring 12 feet, 6 inches in diameter. The traditions of the Easter Islanders are not explicative, and it is most reasonable to regard the megaliths as surviving from an antecedent culture.

The hyloglyphs are small pieces of wood covered with finely incised figures highly conventionalized. Twelve tablets have been collected, and all are preserved save one. The tablets are grooved in shallow channels, and the design is cut in the bottom of the grooves. The few islanders who profess ability to read these records begin at the lower left-hand corner of the tablet, read to the right to the end of the line, invert the tablet and read the second line, and so on in a modified boustrophedon, for in each alternate line the characters have been cut upside down. The reading is far from satisfactory; a version printed in the *Journal of the Polynesian Society* by Dr. A. Carroll, of Sydney, purports to give a record of events in the pre-Inca-Andean culture, but the author did not divulge his method; the version of several tablets recorded by Thomson is very faulty, since it is neither in the language of Easter Island nor in any known Polynesian speech. It is clear that these hyloglyphs, while immemorial, are recent, and, if it can be established that they are literal or syllabic, they form the only instance in which the South Sea Islanders have approached the art of writing, except for a syllabary reported in 1914 from the Caroline Islands as in esoteric use by a few aged chiefs.

The composition and the period of the migration swarm which peopled Easter Island have been established by philological analysis. The nearest affinity is with the Tuamotu (q.v.), showing that at some period the two races were in contact. After deduction of the element of language common to the Tuamotu, the residuum is found to consist of a proto-Samoan element, whose home was in that western archipelago until a period corresponding with the Norman Conquest of England. The settlement of Easter Island cannot have taken place more than 10 centuries ago, and there is reason to regard it as much more recent. Consult: Geiseler, *Die Osterinsel, eine Stätte prähistorischer Kultur* (Berlin, 1883); Thomson, "Te Pito te Henua, or Easter Island," in the *Report of the United States National Museum* (Washington, 1891); Cooke, "Te Pito te Henua," *Report of the United States National Museum* (ib., 1899); Gana,

Viaud, and Ballesteros, *La Isla de Pascua* (Santiago de Chile, 1903); Churchill, *Easter Island, the Rapanui Speech and the Peopling of South-east Polynesia* (Washington, 1912).

**EASTER MACKEREL.** See CHUB MACKEREL.

**EASTERN ARCHIPELAGO.** See MALAY ARCHIPELAGO.

**EASTERN BENGAL AND ASSAM.** See BENGAL; ASSAM.

**EASTERN CHURCH.** See GREEK CHURCH.

**EASTERN EMPIRE.** See BYZANTINE EMPIRE.

**EASTERN QUESTION.** The complicated problem of international politics growing out of the relations of Turkey, the Balkan nationalities, and the Great Powers of Europe to each other and to one another. The problem has occupied the attention of Europe, in more or less degree, since the second half of the eighteenth century, when the rapid curtailment of the Ottoman power through the Russian advance southward seemed to threaten the establishment of Russian supremacy in the southeast of Europe at the expense of Austria. In the beginning the decline of Turkey chiefly concerned only these two powers. Subsequently, however, the interests of Great Britain became more closely bound up with the fortunes of the Turkish Empire as the importance of the British possessions in India increased, and with it the necessity of preserving a safe and short line of communication between England and the Far Orient. France, too, was involved in the web of diplomacy, first and naturally, as one of the Great Powers; secondly, because of its ancient connection with the Porte; and, thirdly, because of the developments resulting from the ambitious schemes of Mehemet Ali (q.v.), of Egypt. Germany, until the very last years of the nineteenth century, disclaimed all interest in the Eastern Question; but at that time German capital had not yet entered extensively into railroad and other business enterprises in Syria, which at present have resulted in establishing close relations with the Ottoman government. The Eastern Question entered upon its modern phase in the Crimean War (q.v.) and assumed definite form at the Congress of Paris in 1856, whose work was slightly modified by the London Protocol of 1871. The opening of a new highway to the East by the Suez Canal and the English occupation of Egypt have helped to complicate the Eastern Question. A new phase of it developed when Russia began a war with Turkey in 1877. The new status created by this war, the full results of which Russia was not allowed to reap, was embodied in the treaty arrangements of the Congress of Berlin (q.v.). This arrangement held through the remainder of the nineteenth century, although considerable changes took place through the annexation of eastern Rumelia to Bulgaria in 1885, the shifting of the boundary between Greece and Turkey as a result of the War of 1897, and the establishment of autonomy in Crete.

Though affairs in eastern Asia have diverted attention from the Eastern Question proper, the problem is still a vital one and fraught with great importance to the future development of international relations. Russia still has her eye on Constantinople; Great Britain must still defend her position in Egypt; above all, Austria-Hungary must in very self-preservation retain her influence among the Slav peo-

ples of the Balkans. The balance of adjustment is delicate, with Austrian influence predominant in Serbia, with Russian influence powerful in Bulgaria, and Greece still anxious to restore in some measure the ancient Byzantine or Greek Empire. In 1909, however, the status quo was suddenly revolutionized. The coup d'état of the Young Turks in the Ottoman Empire; the proclamation of Bulgaria's independence, and the assumption by Ferdinand of the title of Czar; the seizure of Bosnia and Herzegovina by Austria upset entirely the arrangements made at Berlin. The triple alliance of Germany, Austria, and Italy found itself confronted by the triple entente of Russia, France, and Great Britain. Italy in 1911 pounced upon Tripoli (q.v.). A year later the Balkan War (q.v.) drowned the Balkan Peninsula in the most sanguine conflict that war-accursed territory has ever experienced. From that conflict Greece has emerged triumphant; Serbia has largely extended her frontier; Bulgaria somewhat less so; Rumania has gained territory of great economic value; Albania appears as a new country, and Turkey in Europe has shrunk to pitiful dimensions. The Eastern Question, with the exception of the Bagdad Railway problem (q.v.), is primarily concerned with the rivalry between Greece and Italy, Bulgaria and Serbia, Austria and Russia, as to their respective spheres of influence. Consult Holland, *Studies in International Law* (Oxford, 1898), and Hichens, *The Near East* (London, 1913). Consult also the . . . . . under BALKAN WAR, GREECE, TURKEY, BULGARIA, ETC.

**EASTERN RITE, CHURCHES OF THE.** The name given to various bodies of Armenian, Coptic, Greek, and Syrian Christians, most of whom were formerly Nestorians or Eutychians, but who have acknowledged the supremacy of the Pope and returned into communion with Western Christendom. They are commonly known as Uniat churches. See UNIATES.

**EASTERN RUMELIA.** See RUMELIA, EASTERN.

**EASTERN SHORE.** See MARYLAND.

**EASTERN STAR, ORDER OF.** A woman's fraternal organization founded in 1776 and affiliated with Masonry. It had, in 1913, 51 grand chapters and 7500 subordinate chapters and a membership of about 700,000. Its officers are grand matron, grand secretary, and grand treasurer.

**EASTER TERM.** One of the four regular terms of the courts of common law in England. It was formerly dependent upon the movable feast of Easter and was hence called a movable term. It commenced on the Wednesday fortnight after Easter Sunday and lasted till the following Monday three weeks. It was at a later period converted by act of Parliament into a fixed term, beginning on the 15th of April and ending on the 8th to the 13th of May in every year. If any of the days between the Thursday before and the Wednesday after Easter fall within term, no sittings in banc (q.v.) are held on those days, and the term is prolonged a corresponding number of days. See TERM OF COURT.

**EAST FLANDERS.** See FLANDERS, EAST.

**EAST GRAND FORKS.** A city in Polk Co., Minn., 24 miles northwest of Crookston, on the Great Northern and the Northern Pacific railroads (Map: Minnesota, A 3). It is in an agricultural district and carries on an extensive

trade in liquors. The water works are owned by the city. Pop., 1900, 2077; 1910, 2533.

**EAST GREENWICH,** grin'ij. A town and the county seat of Kent Co., R. I., 13 miles south of Providence, on the New York, New Haven, and Hartford Railroad, and on Greenwich Bay, a branch of Narragansett Bay (Map: Rhode Island, C 3). There is a good harbor, also a public library and an academy. The town has a cotton bleachery, dry salter works, and manufactures of dextrin, cotton, and yarn. Pop., 1900, 2775; 1910, 3420.

**EAST HAM.** See HAM, EAST AND WEST.

**EASTHAMPTON.** A town, including three villages, in Hampshire Co., Mass., situated in the valley of the Connecticut, 4¾ miles south by west of Northampton, on the New York, New Haven, and Hartford, and the Boston and Maine railroads (Map: Massachusetts, B 3). There is a large dyeing and mercerizing plant and manufactories of drop forgings, rubber and elastic goods, buttons, shoe web, cotton goods, felt, and yarns. Easthampton has a public library and the Williston Seminary, a well-known preparatory school for boys. The government is administered by annual town meetings. The water works are owned and operated by the municipality. Easthampton was first settled in 1665, was incorporated as a district in 1785, and was organized as a town in 1809. It was the scene of an Indian massacre on May 13, 1704, in which 19 persons were killed. Pop., 1900, 5603; 1910, 8524; 1914 (U. S. est.), 9768.

**EAST HAMPTON.** A town in Suffolk Co., N. Y., at the east end of Long Island, on the Long Island Railroad, 102 miles from New York City. It is noted for its picturesqueness and is a popular summer resort. The building of the Clinton Academy, incorporated in 1784, is now used as a library and town hall. At Montauk Point, near here, an army camp was established after the Spanish-American War. The government is administered by town meetings, held biennially. The town, settled in 1649, came under the jurisdiction of Connecticut in 1657 and under that of New York in 1664. During the Revolution it was frequently pillaged by the English. Pop. (town . . . . . part of Sag Harbor village), 1900, . . . . . 4722. Consult . . . . . *History of the Town of East Hampton* . . . . . 1897), and Gardiner, *Records of East Hampton* (ib.), 1886-89).

**EAST HARTFORD.** A town in Hartford Co., Conn., 2 miles east of Hartford, on the New York, New Haven, and Hartford Railroad, and on the Connecticut River (Map: Connecticut, E 2). It has a town library and the Raymond Library, and a cemetery dating back to 1710. The chief industries are paper making, tobacco growing, and market gardening. There are also railroad and machine shops. East Hartford was settled in 1640-50 and was incorporated in 1783. The government is administered by town meetings. Pop., 1900, 6406; 1910, 8138; 1914 (U. S. est.), 8875. William Pitkin, one of the Colonial governors, was born here. Henry Howard Brownell, the "Battle Laureate" of America, died here.

**EAST HUMBOLDT MOUNTAINS.** A range of lofty mountains in Elko Co., Nev., about 50 miles long, and extending from north to south, about 60 miles west of the Utah boundary (Map: Nevada, F 2). They are a northern continuation of the Ruby Mountains, are well wooded, and are the most rugged range



within the State, several of the peaks reaching a height of from 11,000 to 12,000 feet. They form the parting for most of the streams which flow westward in Nevada. Frémont's Pass is in this range.

**EAST INDIA ARMY.** Originally, the troops in the pay and employment of the East India Company. They were largely natives, with a scattering of European adventurers, liberated convicts, and army deserters. Later a few regiments were raised in England, which since the Act of 1861 reorganizing the Indian army have been a part of the British regular army, under the army numbers of the 105th, 106th, 107th, 108th, and 109th regiments of infantry and the Twenty-first Regiment of Hussars.

Before the Indian Mutiny in 1857 the army in the pay of the East India Company consisted of about 24,000 British regulars, lent from the English military establishment, but paid for by the company; 18,000 European troops, raised and drilled in England, but the property of the company; 180,000 native regulars; and 60,000 native irregular horse—about 280,000 in all. In 1861 the East India army ceased to exist, the Europeans . . . British army, as before stated, and . . . troop forming the nucleus of what is now the British Indian native army.

**EAST INDIA COMPANY.** The name given to trading companies intrusted by various European governments with the monopoly of their trade with the East Indies. The most important one was the English Company, the original charter of which was obtained from Queen Elizabeth on Dec. 31, 1600, granting for 15 years the monopoly of trade with all parts of the world not held by friendly European powers between the Cape of Good Hope eastward to the Strait of Magellan. There were originally 125 stockholders, from whom were chosen each year the governor and 24 directors to manage all the business of the company. The original stock was £72,000; indeed, the first voyages of the company were undertaken at the risk of such of the stockholders as would advance the requisite capital. In 1612 it was made a joint-stock company with £400,000 capital. At the beginning of the eighteenth century the stock had increased to three millions, and in 1853 it was valued at six.

At first the venture was esteemed to be of such a precarious nature that the company was aided by exemption from export duties and in other ways. The first voyages, however, were highly successful, and the trade continued to increase, notwithstanding the bitter and often bloody struggles with foreign companies, the wealth of the Orient having attracted other European nations than the English. The Portuguese had a practical monopoly of the trade during the sixteenth century, but they made but sorry traders, being rather concerned with establishing an empire and spreading Catholicism. With them the whole trade was a royal monopoly. When Portugal was united with Spain under Philip II, nearly all its East Indian possessions were lost to the Dutch in the wars of the latter against Spain. The Dutch, who were traders only, looking for immediate returns and being without farsighted plans of future gains and empire, did not maintain their great advantage. In their struggle with the English Company they indeed maintained their establishments in the Spice Islands, Sumatra, Java, Malacca,

and elsewhere, and drove the English away, but they lost their possessions in India. Then came the most serious struggle between the English and the French Company, the latter having been established in 1664. It began in 1745 and was not finally terminated until 1761. Victory fell to the English through the genius of Clive, who was almost matched by the Frenchmen La Bourdonnais and Dupleix. These wars caused the Europeans to mingle in the affairs of the native states, with the result that during the eighteenth century the English Company had become a great territorial power and laid the foundations of the British Empire in India.

As a trading organization, it held for over 200 years the practical monopoly of the trade of Great Britain with the Far East. The most important trade was with India and China, importing tea, pepper, spices, drugs, calicoes, silks, diamonds, etc. Its chief exports were the precious metals, for which reason the company was from its inception very unpopular at home. According to the current economic doctrine of the day, only that trade should be encouraged which found markets for English goods and brought money into the country, thereby promoting the national welfare. It was urged in reply that more money came into England by the sale of Oriental goods than the company could possibly take away—reasoning which experience proved to be correct.

For this and other reasons the stockholders often had difficulty in getting their charter renewed, having usually to pay for it by a loan to the government or some other service, although they usually succeeded in maintaining their monopoly. In 1650 and again in 1655 they absorbed rival companies, which had been incorporated under the Commonwealth and Protectorate. Indeed, in 1653, the experiment of free trade with India was tried, but proved a failure. After the revolution of 1688, which in the Declaration of Rights maintained the right of interlopers to trade, the company experienced great difficulty in obtaining a parliamentary charter in addition to the royal charter they already possessed. Parliament was opposed to monopolies on principle and favored the admission of interlopers to the trade. The company maintained that the interlopers were quite irresponsible and, if unsuccessful in trade, often took reprisals on the natives and embroiled them with the latter. Nevertheless, a new general company, open to all individuals, was established in 1698. After bitter struggles and great confusion in the trade both companies were united by Act of Parliament in 1702. Every member holding over £500 of stock was entitled to from one to four votes, according to his holding, in the general court of proprietors, who elected the governor and a board of 24 directors from among the holders of not less than £2000 of stock. The directors were chosen for four years, six retiring each year.

Meanwhile the increasing political power of the company furnished endless opportunities for corruption among its servants in India and for misrule and oppression of the natives. Its baneful influence in corrupting Parliament was well known. It was quite natural, therefore, that in 1773 a more complete control by the government was established. In 1784 an Act originated by the younger Pitt gave to the King the power of appointing a board of control over the civil and military, but not the commercial, acts of

the company. In 1813 the trade with India was thrown open, the company maintaining its existence as a political body for the government of India only, and in 1833 its last great monopoly, the trade to China, was abolished, the dividends of the company being guaranteed by taxes levied on the India possessions. Its inability to cope with the terrible Indian revolt of 1857 gave Parliament reason for concentrating all its powers in the Imperial government, which guaranteed a 10½ per cent yearly dividend on £6,000,000 of its stock. Henceforth the East India Company continued to exist as an agent for receiving and distributing these dividends only.

The Dutch East India Company was incorporated by the States-General of Holland in 1602, with a capital of about 6,600,000 florins. It was the union of several smaller companies which had been formed in consequence of successful voyages to the Spice Islands, beginning with 1595, when Philip of Spain closed the port of Lisbon to the Dutch. Its monopoly extended from the Cape of Good Hope to the Strait of Magellan, with sovereign rights in whatever territory it might acquire. The first expeditions (1602-05) were very successful and resulted in permission from the native states to use a large number of ports and to build a fortified factory in Java. In 1605 began the 60 years' war with Spain, at the end of which the Dutch Company had despoiled Portugal, which was then united with Spain, of all its East Indian possessions and had supplanted the Portuguese in the Sunda and Molucca islands, Ceylon, the Malabar Coast, Malacca, Japan, and the Cape of Good Hope. As a basis of their power, the Dutch secured vast territorial possessions in the Sunda Islands, especially in Java, Sumatra, and Celebes, and in the Moluccas. They had other stations, but they were for trade only and were unfortified. The most influential founder of the Dutch Indian Empire was Governor Jan Pietersz Coen, who in 1619 established Batavia in Java as its capital. Hither came the ships from all the other stations, a centralization which enabled them to control the trade. In the insular possessions of the company the native governments were left in control, subject only to taxes and to the trade monopoly of the company.

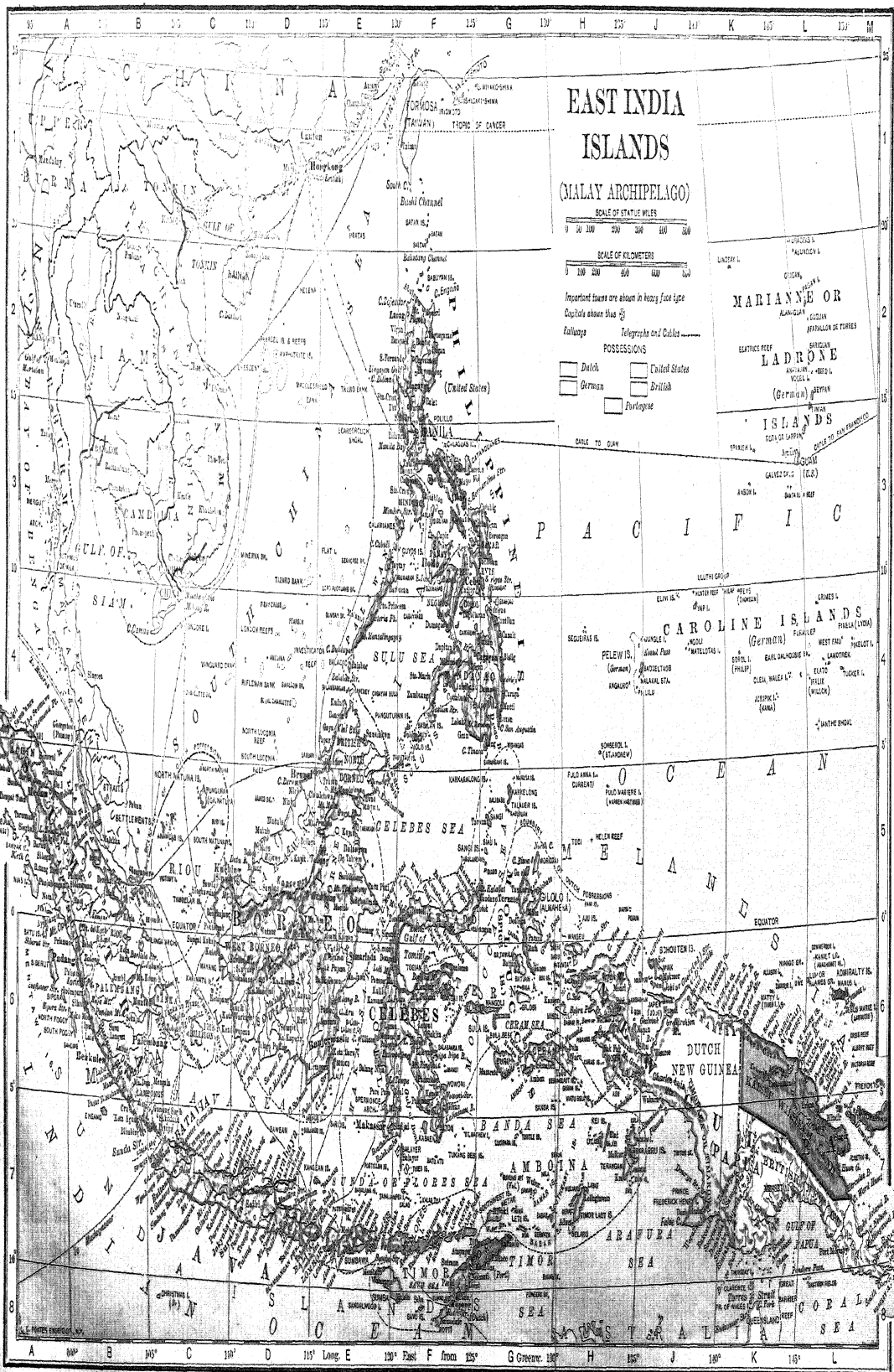
Directed by practical merchants of experience, the company prospered. Between 1602 and 1696 the dividends were never less than 12 and sometimes as high as 63 per cent. The charter was renewed every 20 years, in return for financial concessions made to the state, to which the company in 1696 contributed 8,000,000 florins, in addition to 400,000 florins for the privilege of raising taxes. It was of far greater importance than any other company during this period. But in the eighteenth century came the decline, due to the control of the company by a few rich families, who used it as a means of immediate gain, and to its cruel conduct towards the natives, by which its territorial possessions came into great disorder. No dividends were paid after 1724. When the English attacked its possessions in 1780, on the pretext that Holland was about to join the league of neutrals in favor of America, the Dutch Company was incapable of resistance. It lost practically all of its possessions, and although most of them were returned to Holland by the Treaty of 1815, in the meantime (1798) the company itself had been abolished and its possessions incorporated with those of the state, which also assumed its debts.

The French East India Company was established in 1664, during the reign of Louis XIV, through the instrumentality of Colbert, under the name of La Compagnie des Indes Orientales. Its original capital was 6,000,000 livres, afterward increased to 15,000,000, of which the King subscribed 3,000,000. It was founded under favorable conditions, with almost complete sovereignty of the territory it might acquire, and with all possible protection from the French government. It served the political purpose of operating against the powerful Dutch Company, against which, however, it made but little headway. Under the governorship of the Dutchman Caron the first French factory was established at Surat, and successful negotiations were begun with Persia and Indo-China. His successor, François Martin, founded Pondicherry in 1676, and under his long and prudent administration, which lasted till 1727, the affairs of the company prospered. In 1687, however, the company lost its privilege of trade with China, and in 1719 it was united with the Compagnie des Indes Occidentales and the Compagnie de la Chine into the Compagnie des Indes.

The united company was one of the schemes of Law, and its stocks shared the fate of his speculations. (See MISSISSIPPI BUBBLE.) In 1730 it was deprived of the trade with Africa, in 1731 of the trade with Louisiana, and in 1736 of the coffee trade with America. But the company prospered in India under the able governor Dumas (1735-41), who, by taking advantage of the quarrels among the natives, greatly extended its possessions and influence. Equally successful was his illustrious successor, Dupleix (1741-54), ably supported in military matters by La Bourdonnais (q.v.). Notwithstanding his able conduct of affairs against the English, he was recalled in 1753, and, unsupported by the home government, the colony was unable to maintain itself against Clive. (See the account of the English Company given above.) The activity of the French Company was suspended by royal decree in 1769, and in the following year it turned over its capital, amounting to over 500,000,000 livres, to the King. In 1785 a new company, with commercial privileges only, was established, but it was definitely abolished by the Convention in 1794.

**Danish East India Company.** After unsuccessful attempts in 1616 and 1634, a Danish company was established in 1729 by King Frederick IV. Unfettered by the trade restrictions under which the other companies labored, it became at the end of the eighteenth century one of the principal trading companies of Europe. Its prosperity declined with the advance of the English Empire in India, and it was ruined in the war between Great Britain and Denmark in 1801. Its possessions, of which Tranquebar and Serampur were the chief, were sold to Great Britain in 1845.

**Bibliography.** For information concerning the ENGLISH COMPANY, consult: *Charters Granted to the East India Company from 1601: Treaties and Grants from the Princes of India from 1756 to 1812* (London, n. d.); *The Law Relating to India and the East India Company* (ib., 1841); Stevens, *Dawn of British Trade to the East Indies* (ib., 1886), consisting of reprints of the minutes of the company's meetings during the early period. The standard work on the subject is J. Bruce, *Annals of the East India Company* (ib., 1810); Sir W. W. Hunter,



# EAST INDIA ISLANDS

(MALAY ARCHIPELAGO)

SCALE OF STATUTE MILES  
0 50 100 150 200 250 300

SCALE OF KILOMETERS  
0 100 200 300 400 500

Important towns are shown in heavy face type  
Capitals shown thus

Telegraphs and Cables

POSSSESSIONS  
Dutch  
German  
Portuguese  
United States  
British  
Dutch

MARIANNE OR

LADRON

(German)

ISLANDS

CAROLINE ISLANDS

(German)

PELEW IS.

ANGAU

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*History of British India* (Oxford, 1899), and J. A. Mills, *History of British India*, ed. by H. H. Wilson (London, 1858), are also valuable. An excellent brief modern account from the economic standpoint is W. Cunningham, *Growth of English Industry and Trade in Modern Times*, pp. 26-29, 125-132, 267-278, 532-570, 593-597 (Cambridge, 1892). Dr. Macpherson, *Annals of Commerce* (London, 1805), is standard. Consult also: W. T. Raynal, *A Philosophical and Political History of the Settlement and Trade in the East and West Indies* (ib., 1777); J. Macpherson, *The History and Management of the East India Company* (ib., 1779); *Letters Received by the East India Company from its Servants in the East* (6 vols., ib., 1902), ed. by Wm. Foster; Beckles, *Ledge and Sword* (ib., 1903); F. P. Robinson, *Trade of the East India Company from 1709 to 1813* (New York, 1912); William Foster, *English Factories in India, 1618-45* (7 vols., Oxford, 1906-13); E. B. Sainsbury, *Calendar of the Court Minutes, 1635-54* (4 vols., ib., 1907-13).

For the foundation of the DUTCH COMPANY, consult Van der Chijs, *De Stichting der Oost-Indische Compagnie* (Leyden, 1857); for its early laws, *Verzameling van instructies, ordonnancien en reglementen voor de regeering van Nederlansch-Indië* (Batavia, 1848). General histories of the company and its career are those of Van Kampen (Haarlem, 1831-33); Meinsma (Delft, 1872-73); Lauts (Groningen, 1853-66); Terwogt (Hoor, 1891); Deventer (The Hague, 1886-87); Jonge (ib., 1886-1895).

For information about the FRENCH COMPANY, consult: Castonnet des Fosses, *L'Inde française avant Duplex* (Paris, 1887); Dufresne de Francheville, *Histoire de la Compagnie des Indes* (ib., 1746); Weber, *La Compagnie française des Indes* (ib., 1904); Grolons, *La Compagnie française des Indes orientales de 1664 considérée comme société de commerce* (ib., 1911).

**EAST INDIA HOUSE.** The home of the East India Company, on Leadenhall Street, London, removed in 1862. Its noted museum was removed to Fife House, Whitehall, and in 1880 was placed under the management of the South Kensington Museum. Charles Lamb, James Mill, and John Stuart Mill held clerkships in the East India House.

**EAST INDIAN DUCK.** A variety of domestic duck. See DUCK.

**EAST INDIES.** The southeastern part of Asia, embracing India and Indo-China and the Malay Archipelago. In this broad sense the term is now obsolescent, "East Indies" now usually meaning the Malay Archipelago alone. Most of the archipelago belongs to the Netherlands and is called Dutch East Indies. (See accompanying map.) The name "Indies" originated in the fifteenth century, and its meaning was afterward extended to include the newly discovered lands in the New World. Later a distinction was made between the West and East Indies. See DUTCH EAST INDIES; MALAY ARCHIPELAGO.

**EASTINGS.** See SAILINGS.

**EAST JORDAN.** A city in Charlevoix Co., Mich., 145 miles by rail northwest of Bay City, on Pine Lake, which has deep-water connection with Lake Michigan, and on the Michigan Central and the Pere Marquette railroads (Map: Michigan, D 3). It is in an agricultural and lumbering region, and has machine and car-repair shops, an iron furnace, saw and lath

mills, flour mills, a creamery, a cooperage, and manufactories of wood alcohol, library tables, brick flooring, chemicals, etc. The city adopted the commission form of government in 1911. It owns its water works. Pop., 1900, 1205; 1910, 2516.

**EAST KINGDOM.** See AUSTRASIA.

**EAST LAKE.** Formerly a town in Jefferson Co., Ala., now incorporated into the city of Birmingham (Map: Alabama, C 2). Howard and the Alabama Boys' Industrial School are here.

**EASTLAKE, SIR CHARLES LOCK** (1793-1865). An English historical and figure painter and art critic. He was born at Plymouth, Nov. 17, 1793, the youngest son of George Eastlake, solicitor to the Admiralty and judge advocate of Plymouth. He studied in the schools of the Royal Academy in 1809 and also under Haydon. As early as 1810 he attracted attention with "The Raising of Jairus's Daughter." In 1815 Eastlake was in Paris, studying and copying pictures from the Louvre. He was at Plymouth when Napoleon arrived there on board the *Bellevue*; from a boat he made sketches which he used for a portrait of the Emperor. In 1817 he went to Italy and in 1819 to Greece. Afterward he returned to Rome and there spent 14 years. He devoted himself chiefly to landscape painting and landscape with figures of Italian peasantry. He lived principally in Rome until he was elected an Academician in 1830, when he settled in London. In 1823 he sent to the Royal Academy three so-called "banditti" pictures, with views of Rome, and in 1827 "The Spartan Isidas," now in possession of the Duke of Devonshire, attracted much attention. In 1841 Eastlake was appointed secretary to the Royal Commission for decorating the Houses of Parliament, in 1842 librarian to the Royal Academy, and in 1843 keeper of the National Gallery. In 1850 he was knighted and elected president of the Royal Academy, and in 1855 director of the National Gallery. From that time until his death he was chiefly engaged in selecting pictures to be bought by the government for the National Gallery. He died in Pisa, Dec. 14, 1865. Eastlake translated and edited several books on painting, among them Goethe's *Theory of Colors* (1840) and Kugler's *Schools of Painting in Italy* (1842). He also wrote many articles for periodicals, and some books, notably *Materials for the History of Oil Painting* (1847) and *Contributions to the Literature of the Fine Arts* (1848; 2d series, 1870). As a painter, however, he is less important, being a representative of academic eclecticism. Among his principal paintings are "Pilgrims in Sight of Rome" (1825), considered his masterpiece; "Lord Byron's Dream" (1829), in the Tate Gallery, London; "Gaston de Foix" (1838); "Christ Blessing Little Children" (1840); and a series of female heads, artistically his best effort. For his life, consult the *Memoir* by Lady Eastlake (London, 1870); Monkhous, *Pictures by Sir Charles Eastlake* (ib., 1875).

**EASTLAKE, LADY ELIZABETH** (RIGBY) (1809-93). An English author, born at Norwich, England. She lived for some time in Germany and at Reval, in Russia, and in 1841 her first book, an account of her residence at the latter place, entitled *A Residence on the Shores of the Baltic*, was published in London. In 1842 an introduction to Lockhart led to her becoming a regular staff contributor to the *Quarterly Review*, a connection which continued for many

years. She married Sir Charles Lock Eastlake, the artist, in 1848, and traveled with him extensively in Italy. Her attack, in the *Quarterly Review* (1848), on *Jane Eyre*, is the least pleasant episode of her literary career. She published *The Jewess*, a novel (1843); *Livonian Tales* (1844); *Music and the Art of Dress* (1852); *Life of John Gibson, R.A., Sculptor* (1870); *Life of Mrs. Grote* (1880); *Five Great Painters* (2 vols., 1883). She translated Waagen's *Treasures of Art in Great Britain* (4 vols., 1854-55) and Brandl's *Samuel Taylor Coleridge and the English Romantic School* (1886), and edited her husband's works (1870) and his edition of Kugler's *Handbook of Painting: Italian Schools* (1874).

**EAST LIVERMORE.** A town in Androscoggin Co., Me., 23 miles (direct) north of Lewiston, on the Maine Central Railroad, and on the Androscoggin River (Map: Maine, B 4). It is in a rich farming region and has paper mills. The water works are owned by the town. Pop., 1900, 2129; 1910, 2641.

**EAST LIVERPOOL.** A city in Columbiana Co., Ohio, 44 miles west by north of Pittsburgh, Pa., on the Pennsylvania and the Young-town and Ohio River railroads, and on the Ohio River (Map: Ohio, J 4). It has a Carnegie library and three parks. Two bridges connect the city with Chester and Newell, W. Va. East Liverpool is the most important centre in the United States for the manufacture of porcelain, including porcelain dinner ware, floor tile, and porcelain electrical supplies. There are also machine shops, steel works, a large sewer-pipe factory, and brickworks. The city has a supply of natural gas. The government, under the Ohio Code of 1902, is vested in a mayor and a board of public service, biennially elected, and a council. The board of public safety is appointed by the executive and council. The water works are the property of the municipality. East Liverpool was settled as early as 1795 and was incorporated in 1834. Pop., 1900, 16,485; 1910, 20,387; 1914 (U. S. est.), 21,877.

**EAST LONDON.** A seaport town and popular resort of Cape of Good Hope Province, situated at the mouth of the Buffalo River, on the east coast (Map: Africa, G 8), 666 miles south of Johannesburg by rail. It has a number of banks, a municipal market, two public libraries, and several consular representatives. There is a spacious landing at the mouth of the river, accessible for vessels drawing 22 feet, though the harbor is exposed. The town, being the entrepot for the Transkei, Basutoland, the southern part of Orange Free State, and Johannesburg, is one of the most important ports of Cape Colony, its trade in 1913 amounting to \$67,459,700. The chief article of export is wool. Pop., 1904, 25,220; 1911, 20,867.

**EAST LOTHIAN,** 15<sup>TH</sup>-*an*. See HADDINGTONSHIRE.

**EAST MAIN.** A former portion of the Hudson Bay territories, now incorporated as the Ungava district (q.v.), in the Dominion of Canada (Map: Canada, Q 5). The East Main or Slade River crosses its southern section, entering James Bay, the southern extension of Hudson Bay, about lat. 52° 15' N., after a course of 400 miles.

**EASTMAN, CHARLES ALEXANDER (OHYESA)** (1858- ). An American physician, born at Redwood Falls, Minn. His father, "Many Lightnings" (Jacob Eastman), was a full-blooded

Santee Sioux Indian, and his mother, Nancy, was a half-blood Sioux. He graduated from Dartmouth College in 1887 and from the medical department of Boston University in 1890. From 1890 to 1893 he was government physician at the Pine Ridge Agency, where he had charge of the wounded prisoners at the time of the Ghost Dance Outbreak. He also served as Indian secretary under the International Committee of the Young Men's Christian Association (1894-97), attorney for the Santee Sioux at Washington (1897-1900), and government physician at Crow Creek, S. Dak. (1900-03). In 1903 he received an appointment to revise Sioux family names. He became widely known as a lecturer on Indian history and life. He is author of *Indian Boyhood* (1902); *Red Hunters and the Animal People* (1904); *Old Indian Days* (1907); *Wigwam Evenings* (1909), with his wife (see GOODALE, ELAINE); *The Soul of the Indian* (1911); *Indian Child Life* (1913).

**EASTMAN, CHARLES GAMAGE** (1816-61). An American editor and poet. He was born at Fryeburg, Oxford Co., Me., and attended the University of Vermont in 1837. His poems: the *Spirit of the Age*, published at Woodstock (1840), and in 1846 he became the proprietor of the *Montpelier Patriot*, which he edited for nearly 15 years. In 1848 he published a volume of his poems, in which his delineations of the rural life of New England secured for him the title of the "Burns of the Green Mountains."

**EASTMAN, ELAINE GOODALE.** See GOODALE.

**EASTMAN, GEORGE** (1854- ). An American inventor and capitalist, born at Waterville, N. Y., and educated at Rochester, N. Y., where he thereafter resided. He perfected a process for making sensitive gelatin dry plates and invented a plate-coating machine in 1880. Four years later he patented the first successful rollable film, and in 1888 he perfected the first "Kodak." In 1890 he obtained a patent for the first machine for manufacturing transparent film rolls. He became treasurer and general manager of the Eastman Kodak Company, the manufacturing and distributing plant in Rochester, managing director of the Kodak Company, Ltd., London, England, and president of the Eastman Kodak Company of New Jersey. In 1900 he was made a chevalier of the Legion of Honor. He gave \$225,000 to the Rochester Mechanics Institute in 1900, physical and biological laboratories to the University of Rochester, and in 1912, \$500,000 towards the endowment of the latter institution.

**EASTMAN, HARVEY GRIDLEY** (1832-78). An American educator, born in Marshall, N. Y. He was the founder in 1855 of a commercial school at St. Louis and in 1859 of the Eastman National Business School at Poughkeepsie, N. Y.

**EASTMAN, JOHN ROBIE** (1836-1913). An American astronomer, born at Andover, N. H. He graduated from Dartmouth College in 1862, until 1865 was an assistant in the United States Naval Observatory, where (1874-91) he had charge of the meridian-circle work, and was professor of mathematics in the United States navy (1865-98). Retired in 1898 with the grade of captain, he was in 1906 promoted rear admiral. He observed solar eclipses in various parts of the world, in 1882 had charge of the Transit of Venus party to Cedar Keys, Fla., was the first president (1898) of the Washington Academy of Sciences, and published, besides many reports, *Second Washington Star Cata-*



*logue* (covering the results of about 80,000 observations made between 1866 and 1891), *Transit Circle Observations of the Sun, Moon, Planets, and Comets* (1903), and a *History of the Town of Andover, N. H., 1751-1906* (1910).

**EASTMAN, SETH** (1808-75). An American soldier. He was born at Brunswick, Me., and in 1829 graduated at the United States Military Academy and was assigned as lieutenant in the First Infantry. After serving on frontier duty at Forts Crawford (1829) and Snelling (1830) and on topographical duty from 1831 to 1833, he was appointed assistant instructor in drawing at West Point (1833-40). From 1850 to 1857 he was engaged in the Bureau of Indian Affairs as illustrator of the *History, Condition, and Future Prospects of the Indian Tribes of the United States*. He was promoted through successive grades to be a lieutenant colonel of infantry (1861), was retired in 1863, and brevetted brigadier general in 1866. He wrote a *Treatise on Topographical Drawing* (1837).

**EAST MAUCH CHUNK.** A borough in Carbon Co., Pa., 53 miles south by east of Wilkes-Barre, on the Lehigh Valley, the Central of New Jersey, and the Mauch Chunk Switch Back railroads, and on the east bank of the Lehigh River (Map: Pennsylvania, K 5). It is in the anthracite coal region and has silk mills. Pop., 1900, 3458; 1910, 3548.

**EAST MOLINE,** mō-lēn'. A city in Rock Island Co., Ill., 5 miles east of Moline, on the Mississippi and Rock rivers, and on the Chicago, Milwaukee, and St. Paul, the Chicago, Rock Island, and Pacific, the Davenport, Rock Island, and Northwestern, and the Chicago, Burlington, and Quincy railroads. The industries include manufactures of automobiles, agricultural implements, scales, gas engines, malleable iron goods, sashes and doors, cement blocks, and brick. East Moline was incorporated as a village in 1903 and as a city in 1907. It owns its water works. Pop., 1910, 2665.

**EAST NEWARK.** A borough in Hudson Co., N. J., adjoining Newark, on the east bank of the Passaic River and on the Erie Railroad. It is the home of the Clark Thread Company. The borough contains a public library. Pop., 1900, 2500; 1910, 3163.

**EASTON,** es'ton. A city and the county seat of Talbot Co., Md., 59 miles by rail southeast of Baltimore, on the Baltimore, Chesapeake, and Atlantic, and the Philadelphia, Baltimore, and Washington railroads (Map: Maryland, G 3). It is connected with Baltimore by steamship lines. Easton is the seat of a bishop of the Protestant Episcopal church and contains a hospital. The industrial establishments include foundries and machine shops, flour and lumber mills, canning factories, carriage and wagon works, and furniture and shirt factories. Easton is governed by a mayor and council. The water works, electric-light plant, and sewage system are owned by the city. Pop., 1900, 3074; 1910, 3083.

**EASTON.** A town, including several villages, in Bristol Co., Mass., 24 miles south of Boston, on the New York, New Haven, and Hartford Railroad (Map: Massachusetts, E 3). It has a public library and some fine public buildings, gifts of the Ames family, showing some of the best work of H. H. Richardson and John Lafarge. There are extensive manufactures of shovels, foundry and machine-shop products, hardware specialties, wire goods, automobiles, lace ma-

chinery, shoes, etc. Pop., 1900, 4837; 1910, 5083.

**EASTON.** A city and the county seat of Northampton Co., Pa., at the junction of the Delaware and Lehigh rivers, 50 miles (direct) north of Philadelphia, and 77 miles by rail west by south of New York (Map: Pennsylvania, L 5). It is on the Pennsylvania, the Lehigh Valley, the Central of New Jersey, the Lackawanna, and the Lehigh and Hudson River railroads, and is connected by canals with New York, Philadelphia, and the coal regions. The city is near the great cement belt and near slate quarries and coal and iron fields. It has manufactures of drills, compresses, pumps, stoves, pipes and castings, railway supplies, organs, crayons, agricultural implements, blast furnaces, carved and turned wood, textile and woolen goods, silk, hosiery, braces, etc. Easton is the seat of Lafayette College (q.v.), founded in 1832, and contains an academy, preparatory school, school of music, hospital, and a public library. The commission form of government was adopted in 1913. Easton owns and operates its electric-light plant. Pop., 1890, 14,481; 1900, 25,238; 1910, 28,523; 1914 (U. S. est.), 29,882. Easton was laid out in 1750, was incorporated as a borough in 1789, and was chartered as a city in 1887. Here in 1756, 1757, 1758, and 1761 important treaties were made with the Indians, and in 1779 General Sullivan's expedition against the Iroquois was organized. Consult Condit, *The History of Easton* (Easton, 1889).

**EASTON, MORTON WILLIAM** (1841- ). An American philologist. He was born at Hartford, Conn., and, after attending Yale and Columbia, took a supplementary course at the University of Vienna. After occupying the chair of comparative philology at the University of Tennessee for several years, he was appointed to a similar post in the University of Pennsylvania. His writings include: *Observations on the Platform at Persepolis* (1892); *Readings in Gower* (1895); contributions to the *Journal of the American Oriental Society* on phonetics, Sanskrit, Iranian, and kindred subjects; to the *Transactions of the American Philological Association*, the *American Journal of Philology*, and similar publications.

**EASTON, NICHOLAS** (1593-1675). A Colonial governor of Rhode Island. A tanner by trade, he emigrated from Wales to Massachusetts in 1634, was one of the first settlers of Newbury, Mass., in 1635, and in 1638 built the first English house in Newbury, N. H. He was associated with Anne Hutchinson at Aquidneck in 1638, and in 1639 went to the site of the present Newport, R. I., where also he built the first house. He was President of Providence Plantations in 1648, 1649, and 1650, and again in 1654, served for four years as Deputy Governor, and in 1672-74 was Governor under the second charter.—His son JOHN was Governor from 1690 to 1695 and was the author of a *Narrative of the Causes which Led to King Philip's War*, which was edited by Franklin B. Hough (Albany, 1858).

**EAST ORANGE.** A city in Essex Co., N. J., adjoining Newark, on the Erie and the Lackawanna railroads (Map: New Jersey, D 2). It is primarily residential, containing the handsome suburban homes of many New York and Newark business men. East Orange has well-paved and shaded streets and has munic-

ipal playgrounds, an orphan asylum, a woman's club, a fine high-school building, and a large Carnegie library. Its industrial plants include electrical works and manufactories of pharmaceutical supplies, brass and iron castings, and bread. The government is administered by a mayor, elected biennially, and a city council. All municipal officials are appointed by the executive with the consent of the council. The water works are owned by the city. East Orange was part of Orange until 1863, when it was incorporated as a separate township. In 1899 it was chartered as a city. Pop., 1900, 21,506; 1910, 34,371; 1914 (U. S. est.), 39,852. Consult Whittemore, *The Founders and the Builders of the Oranges* (Newark, 1896).

**EAST PALESTINE.** A village in Columbiana Co., Ohio, 18 miles south of Young-town, on the Pittsburgh, Fort Wayne, and Chicago Railroad (Map: Ohio, J 4). The industrial establishments include potteries, coal mines, terra-cotta and tile works, machine shops, and a rubber factory. The village owns its water works and electric-light plant. Pop., 1900, 2493; 1910, 3537.

**EAST PITTSBURGH.** A borough in Allegheny Co., Pa., 3 miles southeast of Pittsburgh, on the Pennsylvania, the Bessemer, and Lake Erie, and the Union railroads. Factories of the Westinghouse electric and machine companies are situated here, and there are manufactories of meters, machines, steel and rails, and furnaces. Adjoining East Pittsburgh is Braddock's Field, the site of the defeat of General Braddock's forces by the French and Indians in 1755. Pop., 1900, 2883; 1910, 5615.

**EAST POINT.** A city in Fulton Co., Ga., 6 miles southwest of Atlanta, on the Central of Georgia and the Atlanta and West Point railroads (Map: Georgia, B 2). It has oil mills, fertilizer factories, saw and planing mills, iron works, cotton mills, and manufactories of saws, wagons, collars, etc. Pop., 1900, 1315; 1910, 3682.

**EASTPORT.** A city and port of entry in Washington Co., Me., 135 miles by rail from Bangor, on Moose Island, in Passamaquoddy Bay, and on the Maine Central Railroad (Map: Maine, F 4). It is the easternmost city in the United States, possesses a deep harbor, and has steamboat communication with important points on the coast. Eastport is the centre of large fishing and sardine-canning interests. The city contains a customhouse and a public library. The government is administered under a charter of 1893, by a mayor, elected annually, and a board of aldermen. Pop., 1900, 5311; 1910, 4961. Eastport was permanently settled about 1782. Its trade was severely crippled by the Embargo Act, and the town was for several years, especially during 1807-18, notorious as a smuggling centre. Great Britain had long claimed all the islands in Passamaquoddy Bay, and on July 11, 1814, an English force captured Eastport and held it under strict martial law until June 30, 1818. Consult Kilby, *Eastport and Passamaquoddy: A Collection of Historical and Biographical Sketches* (Eastport, 1888).

**EAST PROVIDENCE.** A town in Providence Co., R. I., separated from the city of Providence by the Seekonk River, on the New York, New Haven, and Hartford Railroad (Map: Rhode Island, C 2). It has chemical, electrical, and wire works, a shoe-string factory, and a bleachery. The government is vested in a town

council, which elects a majority of administrative officials, others being chosen by popular vote. Town meetings are held annually. Together with the town of Seekonk, Mass., East Providence was once a part of the old town of Rehoboth. It was set off from Seekonk when the Massachusetts-Rhode Island boundary line was fixed, and was incorporated in 1862. Pop., 1890, 8422; 1900, 12,138; 1910, 15,808; 1914 (U. S. est.), 17,369.

**EAST RETFORD,** rētfērd. A municipal borough and market town in the County of Nottingham, England, on the Idle, an affluent of the Trent, 138 miles north-northwest of London (Map: England, F 3). The town has a handsome town hall, corn exchange, and market hall. It owns its gas and water supply (both of which yield profits) and maintains public baths, markets, and slaughterhouses. There are iron foundries and manufactories of paper and India rubber, and a considerable trade in hops is carried on. Pop., 1901, 12,340; 1911, 13,385. Retford appears in Domesday and received its first charter from Edward I.

**EAST RIVER.** The strait . . . Long Island Sound and upper New York Bay (Map: New York City, E 5). It is also connected on the north, through the Harlem River and Spuyten Duyvil Creek, with the Hudson. It separates the boroughs of Manhattan and the Bronx on the west and north from those of Brooklyn and Queens on the east and south. It is about 15 miles long and varies from less than  $\frac{1}{2}$  mile to  $3\frac{1}{2}$  miles in width. Its principal islands are Blackwell's, Ward's, Randall's, Riker's, and North Brother, containing city institutions. A channel between Ward's Island and Long Island, in what is known as Hell Gate, has been made navigable by the Throgs Neck Brooklyn Bridge, and the Williamsburg Bridge, and the Manhattan Bridge.

**EAST RUTHERFORD.** A borough in Bergen Co., N. J., 9 miles from Jersey City, on the Erie Railroad (Map: New Jersey, D 2). It is essentially a residential place for New York business men, and contains a public library. The chief industrial establishments are extensive cotton and linen bleaching works, a steam boiler factory, and a manufactory of glass mirrors. Pop., 1900, 2640; 1910, 4275.

**EAST ST. LOUIS.** A city in St. Clair Co., Ill., on the Mississippi River, connected by several bridges with St. Louis, Mo., and entered by 20 lines of railroad (Map: Illinois, B 5). East St. Louis is an important manufacturing centre, its industrial interests being promoted by valuable coal deposits in the vicinity. It has manufactories of malleable iron, glass, frogs and switches, aluminum, white lead, paint, bridges, roofing paper, car trucks, car springs, forgings, locomotives, pneumatic tools, and silica, a rolling mill, foundries, a fertilizer plant, grain elevators, baking-powder factories, and flouring mills. There are also stockyards, a large horse and mule market, alfalfa stock feed, and pork and dressed-beef packing industries. The city contains several parks, and its city hall, high school, and the public library occupy fine buildings. East St. Louis was incorporated as a town in 1861 and was chartered as a city in 1865. It is a progressive municipality, having expended in the last decade more than \$7,000,000 in street and other public improvements, principally for drainage and flood protection. The government is administered by a mayor, elected biennially,

and a city council, of which the executive is a member. The city treasurer, city attorney, assessor, city clerk, justices of the peace, and city court judges are elected by the people. East St. Louis has had rapid growth, its population having increased from 5644 in 1870 to 29,655 in 1900; to 58,547 in 1910; and to 69,502 (U. S. est.) in 1914.

**EAST STONEHOUSE.** A town in Devonshire, England, forming, with Plymouth (q.v.) and Devonport (q.v.), the group styled "The Three Towns." Pop., 1801, 1,100; 1911, 13,754.

**EAST STROUDSBURG.** A borough in Monroe Co., Pa., 32 miles north of Easton, on the Delaware, Lackawanna, and Western, the Delaware Valley, the New York, Susquehanna, and Western, and the Wilkes-Barre and Eastern railroads. It is situated in a picturesque region at the foot of the Pocono Mountains, is a popular summer resort, and contains a State normal school. The chief industrial establishments are boiler works, glass factories, silk mills, brass works, and a piano-stool factory. The borough owns its water works. Pop., 1900, 2648; 1910, 3330.

**EAST SYRACUSE.** A village in Onondaga Co., N. Y., 5 miles north of Syracuse, on the New York Central and the Hudson River railroads, and on the Erie Canal (Map: New York, D 4). It has large freight yards of the New York Central system and a silverware factory. The village owns its water works. Pop., 1900, 2509; 1910, 3274.

**EAST THICKLEY.** See SHILDON AND EAST THICKLEY.

**EASTWARD HO!** A comedy by Marston, Chapman, and Jonson.

**EASTWICK, EDWARD BACKHOUSE** (1814-83). An English diplomatist and Orientalist. He was educated at Merton College, Oxford. In 1845 he was appointed professor of Hindustani at the East India Company's College of Haileybury and in 1859 assistant political secretary in the India Office. From 1860 to 1863 he was Secretary of Legation at the court of Persia, in 1864 and 1867 was a commissioner for the negotiation of a Venezuelan loan, and in 1866 was appointed private secretary to Lord Cranborne, the Secretary of State for India. In 1868-74 he represented Falmouth and Penryn as a Conservative in the House of Commons. His publications include translations of (1852) the *Gulistân*, or 'Rose Garden,' of Sâdi, and (1854; republished in Dole and Walker's *Flowers from the Persian Poets*, 1901) the *Anwâr-i Suhaili*, with a *Concise Grammar of Hindustani* (1847, 1858); a translation of Bopp's *Comparative Grammar* (1856); a *Handbook for India* (1859, "Murray's Handbooks Series"); *Journal of a Diplomat's Three Years' Residence in Persia* (2 vols., 1864); *Venezuela: or, Sketches of Life in a South American Republic* (1864; 2d ed., 1868; first published in Dickens's *All the Year Round*); *Lord Lytton and the Afghan War* (1879); and his last work, entitled *Kaisar-namah-i-Hind*, 'The Lay of the Empress' (2 vols., 1878-82).

**EAST WINDOW.** In many English cathedrals, and in a few Cistercian churches on the Continent having square east ends, this end is occupied by a group of windows (Ely, Laon) or by a single large traceried window (Lincoln, Exeter, York, Gloucester). The east window of Gloucester is one of the largest traceried windows in Europe.

**EAST WINDSOR.** A town in Hartford Co., Conn., 11 miles northeast of Hartford, on the New York, New Haven, and Hartford Railroad (Map: Connecticut, E 2). It contains two libraries and has woolen mills, a silk factory, distilleries, and tobacco warehouses. Pop., 1900, 3158; 1910, 3362.

**EAST YOUNGSTOWN.** A village in Mahoning Co., Ohio, 4 miles east of Youngstown, on the Baltimore and Ohio Railroad, and on the Mahoning River (Map: Ohio, J 3). The chief industry is the manufacture of iron. Pop., 1910, 4972.

**EASY, SIR CHARLES.** The title character in Gibber's *Careless Husband*. His tendency towards indolent vice is checked and cured by the sense and tact of an amiable wife.

**EASY, MIDSHIPMAN.** See MIDSHIPMAN EASY.

**EATON, ETON.** A village and the county seat of Preble Co., Ohio, 58 miles north by northwest of Cincinnati, on the Cincinnati, Cincinnati, Chicago, and St. Louis Railroad (Map: Ohio, A 6). It is the centre of a fertile agricultural region and has manufactories of cigars, gloves, cement products, etc. There are many noted springs in the vicinity, and the village contains a public library and municipal water works. It was here that Little Turtle made his last stand against the whites, under John Adair, who was afterward elected Governor of Ohio. Pop., 1900, 3155; 1910, 3187.

**EATON, AMOS** (1776-1842). An American scientist, born in Chatham, N. Y. Graduating from Williams College in 1799, he was admitted to the bar and began the practice of law and civil engineering at Catskill, N. Y. He gave much time to study of the natural sciences, including chemistry, mineralogy, and geology, and in 1820 he was engaged by Stephen van Rensselaer to make a geological and agricultural survey of Albany and Rensselaer counties, one of the first of such undertakings in this country. He afterward made a geological survey of the region along the Erie Canal, from which was constructed a profile section of the rock formations from the Atlantic Ocean across Massachusetts and New York to Lake Erie. In 1824 he became senior professor of the Rensselaer School of Science in Troy, now the Rensselaer Polytechnic Institute. His best-known works are: *An Index to the Geology of the Northern States* (1818); *A Manual of Botany of North America* (1833); *Geological Note Book* (1841).

**EATON, AMOS BEEBE** (1806-77). An American soldier. He was born at Catskill, N. Y., graduated at West Point, and was assigned as lieutenant of Fourth Infantry in 1826. After having served in various garrisons, especially on the northern frontier, he was transferred in 1838 to the Department of Subsistence, and served as commissary. In the Mexican War he was chief commissary of subsistence under Gen. Zachary Taylor, receiving the brevet of major in 1847. During the Civil War he was purchasing commissary at New York City for the armies in the field and in 1864 was appointed commissary general of subsistence at Washington. He rose to the regular rank of brigadier general and in 1865 was brevetted major general. He was retired from active service in 1874.

**EATON, ARTHUR WENTWORTH HAMILTON** (?1859- ). A Canadian poet, essayist, and critic. He was born in Kentville, Nova Scotia,

and was educated at Dalhousie University and at Harvard, where he graduated in 1880. He studied for the ministry of the Protestant Episcopal church, was ordained priest in 1885, and was for a short time rector of a parish at Chestnut Hill, Boston; but he afterward became head of the English department in the Cutler School. His publications include: *The Heart of the Creeds* (1888); *Acadian Legends and Lyrics* (1889); *The Church of England in Nova Scotia* (1891); *Tales of a Garrison Town*, with C. L. Betts (1892); *Acadian Ballads* (1905); *The Lotus of the Nile and Other Poems* (1907); *The History of King's County, N. S.* (1910).

**EATON, CHARLES WARREN** (1857- ). An American landscape painter. He was born in Albany, N. Y., and studied at the National Academy of Design and at the Art Students' League, New York. His canvases, usually evening effects in oil or water color, have often a poetic charm and are truthful in drawing, solid in handling, and softly harmonious in color. Among his landscapes are "The Forest"; "October's Tints"; and "Connecticut Pines" (1910, Brooklyn Museum); "Gray Dunes" and "Forest Lands" (1911); "The Valley of Sunset" and "Among the Dunes" (1912); "The Silent Woods" and "The Pines" (1913); "Gathering Mists" (National Gallery, Washington); and "Dunes at Knocks, Belgium" (Cincinnati Museum). In 1904 he received the Inness gold medal at the National Academy of Design and in 1905 he exhibited at the Paris Salon.

**EATON, DAVID CADY** (1834-95). An American botanist. He was born at Fort Gratiot, Mich., studied at Yale and Harvard, and was professor of botany at Yale from 1864 until his death. He contributed to *Gray's Manual* and to Chapman's *Flora of the Southern States* the parts relating to ferns and published *The Ferns of North America* (2 vols., 1878-79).

**EATON, DORMAN BRIDGMAN** (1823-99). An American lawyer and civil-service reformer. He was born in Hardwick, Vt., was educated at the University of Vermont and the Harvard Law School, and began the practice of law in New York in 1850. In 1866 he drafted the law establishing the Board of Health for New York City and also that creating the municipal police courts. Upon the establishment of the first Civil Service Commission in 1873, he was appointed one of the commissioners by President Grant. He drafted the National Civil Service Act (the Pendleton Act), which became a law in 1883, and was appointed by President Arthur a member of the new commission. He resigned in 1885, but was reappointed by President Cleveland and served until 1886. He published: *Civil Government in Great Britain* (1880); *The Independent Movement in New York* (1880); *The Term and Tenure of Office* (1882); *The Problem of Police Legislation* (1895); *The Government of Municipalities* (1899).

**EATON, EDWARD DWIGHT** (1851- ). An American clergyman and college president, born at Lancaster, Wis. He graduated from Beloit College in 1872 and from Yale Divinity School in 1875 and also studied at Leipzig and Heidelberg. Ordained to the Congregational ministry in 1876, he served the First Church, Oak Park, Ill., from 1879 to 1886; thereafter, except for two years (1905-07) as pastor at St. Johnsbury, Vt., he was president of Beloit

(Wis.) College. He was delegated to inspect Congregational missions in China in 1898, lectured at Andover (Mass.) Theological Seminary in 1904 and at Bangor Theological Seminary in 1906, after 1910 was vice president of the American Board of Commissioners for Foreign Missions, and in 1911 became vice president of the North Central Association of Colleges and Secondary Schools.

**EATON JOHN** (1829-1906). An American educator and Civil War veteran, born at Thetford, Vt. He graduated at Dartmouth College in 1854, studied at Andover Theological Seminary, and was ordained in 1857, Presbyterian ministry. In 1862 General Grant made him superintendent of contrabands, and soon after he became general superintendent of refugees for Mississippi, Arkansas, western Tennessee, and northern Louisiana. In 1863 he was made colonel of the Sixty-third Regiment of Colored Infantry, and in 1865 he was advanced to brevet brigadier general. He reorganized the Bureau of Refugees, Freedmen, and Abandoned Lands, after which he edited the *Memphis (Tenn.) Post* in 1866-67, and in 1867-69 was State superintendent of public instruction in Tennessee. He was appointed United States Commissioner of Education in 1871 and served with great efficiency. In 1886-91 he was president of Marietta College. In 1895 he was appointed president of Sheldon Jackson College at Salt Lake City, and in 1898 he became inspector of education in Porto Rico. His educational writings dealt largely with the education of freedmen and also included a history of Thetford Academy.

**EATON, JOHN HENRY** (1790-1856). An American legislator. He was born in Tennessee and after studying law devoted himself to practice at the bar in Nashville. In 1829 he married Peggy O'Neill. (See EATON, MARGARET.) He was Secretary of War from 1829 to 1831 and Governor of Florida in 1834-36. In 1836-40 he was Minister to Spain. He wrote a *Life of Andrew Jackson* (1824), a campaign biography.

**EATON, MARGARET (O'NEILL)**, best known as PEGGY O'NEILL (c.1796-1879). The wife of J. H. Eaton (q.v.), Secretary of War under President Jackson. She was the daughter of a Washington tavern keeper and noted for her beauty and wit. About 1823 she married a man named Timberlake, a purser in the United States navy, who in 1828 committed suicide while on duty in the Mediterranean. In January, 1829, she was married to Maj. J. H. Eaton, who soon afterward entered President Jackson's cabinet as Secretary of War. Various charges were brought against her in connection with her alleged conduct towards Major Eaton himself while she was still Mrs. Timberlake. On this account the wives of other cabinet members and Washington society generally refused to recognize her. Jackson, an old friend of both Mr. and Mrs. Eaton, endeavored to break down the opposition against her and even seems to have threatened to remove several of the secretaries should their wives remain obdurate; but his efforts met with little success, and partly for this reason Jackson effected an almost complete reorganization of his cabinet. Politically the incident was chiefly significant from the fact that it helped to strengthen the friendship between Jackson and Van Buren, who had ostentatiously befriended Mrs. Eaton,

and to alienate Jackson and Calhoun, then Vice President, whose wife had persistently refused to recognize Mrs. Eaton socially, and thus to assure the nomination of the former in preference to the latter for the presidency by the Democratic party in 1836. In later years Mrs. Eaton was exceedingly popular in the society of Madrid where her husband was Minister of the United States to Spain. Some time after the death of her husband (1856) she married a young Italian dancing master, Antonio Buchignani, then only about 20 years old, from whom she was divorced after he had squandered much of her property. Consult Parton, *Life of Andrew Jackson*, vol. iii (New York, 1860); and an article "Margaret O'Neill Eaton," in the *International Review*, vol. viii (ib., 1880); Buell, *History of Andrew Jackson* (2 vols., New York, 1904); Bassett, *Life of Andrew Jackson* (2 vols., New York, 1911).

**EATON, THEOPHILUS** (c.1591-1658). An English merchant, one of the founders and the first Governor of the Colony of New Haven. He was born at Stony Stratford, Buckinghamshire, England, the son of a minister; became a prosperous merchant; was chosen deputy governor of the East Land Company, and lived for several years in Denmark as an agent of Charles I. After his return he settled in London, where he was a member of the Puritan congregation of the Rev. John Davenport (q.v.), and in 1637 accompanied his pastor to Massachusetts, of whose charter he had been one of the original patentees. Late in the same year he selected a site for a new settlement, and early in 1638 he and Davenport with a small number of followers founded the town and Colony of New Haven (q.v.). In October, 1639, a government was regularly organized and Eaton was chosen chief magistrate, to which position he was annually reelected until his death. He was one of the organizers of the New England Confederation in 1643 and drew up (1655), with the aid of Davenport, the code of laws which have become known as the Connecticut Blue Laws. Consult Moore, "Memoir of Theophilus Eaton," in *Collections of the New York Historical Society*, 2d series, vol. ii (New York, 1849), and a sketch in Mather's *Magnalia*, vol. i (London, 1702).

**EATON, WILLIAM** (1764-1811). An American adventurer, prominent in the war between the United States and Tripoli. He was born in Woodstock, Conn., ran away from home at 16, joined the army and served until 1783, and graduated at Dartmouth in 1790. In 1792 he rejoined the army as a captain and served successively against the Shawnees in Ohio and the Seminoles in Georgia until 1797, when he was appointed American Consul in Tunis. On the outbreak of the Tripolitan War in 1801 he arranged with Hamet, the rightful Pasha of Tripoli, for a combined land and naval attack upon Tripoli; but he was unable to obtain the cooperation of the American naval officers. He then returned to the United States in 1803, and in April, 1804, was appointed Naval Agent of the United States for the Barbary Powers. Late in the same year he returned to northern Africa and raised a force of 500 men, chiefly Arabs and Greeks, with which in March, 1805, he set out across the Libyan Desert for Derne, the second city in importance in the Tripolitan Regency. This place was captured by storm on April 27 and was held against three subse-

quent attacks on the part of the Arabs. Soon afterward, however, Tobias Lear, the United States Consul General at Algiers, and Commodore Rodgers, commander of the United States fleet before Tripoli, concluded with the usurping Pasha, Yussuf, a treaty which provided, among other things, for the immediate evacuation of Derne, and Eaton was thus forced to give up his cherished scheme of restoring Hamet and obtaining more favorable terms for the United States government. He accordingly returned to America in the fall of 1805. His last years were spent in Brimfield, Mass., which town he represented for one term in the Legislature. Consult: *The Life of the Late General William Eaton* (Brookfield, Mass., 1813); Felton, "Life of William Eaton," in Sparks's *Library of American Biography*, vol. ix (Boston, 1838); and the brief sketch in Adams's *History of the United States from 1801 to 1817*, vol. ii (New York, 1889-91).

**EATON, WYATT** (1849-96). An American portrait and figure painter. He was born at Phillipsburg, Quebec, of American parentage, but came early to New York and studied in the National Academy of Design and afterward under Gérôme at the Ecole des Beaux-Arts, Paris. He also spent some time at Barbizon, where he associated with and was strongly influenced by Millet. Eaton belongs to no especial group of painters, but sought inspiration rather from the old masters. The chief characteristics of his art are delicacy of tone and color, grace, and sincerity of conception. His most notable works are his portraits, in which he admirably expresses the spiritual personality of the sitter. His rendering of the hands is especially good. The series of American poets, engraved by Timothy Cole for the *Century Magazine*, established his reputation in this country. Since then the portraits of Cole himself as the "Man with the Violin" and Mrs. R. W. Gilder, exhibited at the Paris Exposition of 1889, have made his reputation international. Other fine portraits are those of W. C. McDonald and Hon. Archie Gordon (1895). He was the first secretary and one of the founders of the Society of American Artists and for some years its president. Among his subject pictures are "Harvesters at Rest" (1876, Smith College); "Reverie"; and "Harvest Scene" (Montreal Gallery).

**EATON HALL**. One of the famous show-places of England, the residence of the Duke of Westminster, the richest peer in England, near Chester. The hall, a fine specimen of Neo-Gothic architecture, is purely modern, erected in 1870-79 by the architect Waterhouse. A well-timbered deer park surrounds it, and gardens and terraces of much beauty are open to the visitor. This park is extensive, the mansion being nearly 3 miles from the lodge gates.

**EATONTON**. A city and the county seat of Putnam Co., Ga., 59 miles by rail north by northeast of Macon, on the Central of Georgia Railroad, and on the Oconee River (Map: Georgia, C 2). It is in an agricultural, fruit and cotton growing, and dairying country, has cotton factories, and carries on an extensive trade in peaches and plums. The water works and sewage system are owned by the city. Joel Chandler Harris, author of the famous Uncle Remus stories, was born here. Pop., 1900, 1823; 1910, 2036.

**EAU CÉLESTE**, ô sâ'lêst'. See FUNGICIDE.

**EAU CLAIRE**, ô klâr. A city and the

county seat of Eau Claire Co., Wis., 89 miles east of St. Paul, Minn., at the junction of the Eau Claire and Chippewa rivers, on the Minneapolis, St. Paul, and Sault Ste. Marie, the Chicago, Milwaukee, and St. Paul, and the Chicago and Northwestern railroads (Map: Wisconsin, B 4). It is the leading commercial centre of this part of the State, is at the head of navigation on the Chippewa, and has good water power in both rivers. Eau Claire is the outlet of the Chippewa lumber district, and its manufactures of lumber are extensive. There are also foundries, a large paper mill, steel and iron works, breweries, canneries, and manufacturing of furniture, refrigerators, boxes, harness, sashes and doors, and shoes. The city has a Carnegie library, four public parks, fine school buildings, a tuberculosis sanatorium, and the Sacred Heart (Roman Catholic) and the Norwegian Lutheran hospitals. The water works are owned by the municipality. Eau Claire adopted the commission form of government in April, 1910, being the first city in the State to do so. Pop., 1900, 17,517; 1910, 18,310; 1914 (U. S. est.), 18,647.

**EAU CRÉOLE**, ô krâ'ôl'. A very fine liqueur, made in Martinique, by distilling the flowers of the mammee apple (*Mammea americana*) with spirit of wine.

**EAU DE COLOGNE**, de kô-lôn' (Fr., Cologne water). A perfume invented in northern Italy by one of the Farina family, who subsequently settled in Cologne. It is now made by a number of persons bearing the original patronymic, who are residents of Cologne, as well as by perfume makers all over the world. It consists essentially of pure distilled alcohol with various aromatic oils so blended as to yield a refreshing and grateful odor. Various formulas have been given for the original perfume, and among these is the following, originally published in the journal of the North German Apothecaries' Association: Dissolve 2 ounces of purified benzoin, 4 ounces of oil of lavender, and 2 ounces of oil of rosemary in 9 gallons of 95 per cent alcohol; to this solution add successively of the oils of neroli, neroli petit-grain, and lemon, each 10% ounces, and of the oils of sweet orange peel, limes, and bergamot, each 20% ounces, together with tincture of rose-geranium flowers, sufficient to suit the taste; macerate for several weeks and then bottle. An excellent imitation is made by taking 6 gallons of 95 per cent alcohol, oil of orange and oil of citron each 5 ounces, oil of neroli 4 ounces, oil of rosemary and oil of bergamot each 2 ounces; mix by stirring, and allow to stand until the solution is complete. It is claimed that the best foreign eaux de Cologne are obtained by distillation, the purpose of which is to secure a perfect blending of the perfumes, but in the United States the same result is generally accomplished by allowing the mixture to stand until the desired effect is obtained.

**EAU DE JAVELLE**, zhâ'vel' (from *Javelle*, near Paris), or **JAVELLE WATER**. A solution of hypochlorite of potash, which is used to remove stains from linen or muslin and from white marble. Practically it is adulterated with bicarbonate of potash. It is poisonous.

**EAUX-BONNES**, ô'bôn'. A watering place in the Department of Basses-Pyrénées, France, 2455 feet above sea level, 20 miles south-southeast of Oloron (Map: France, S, D 6). It is picturesquely situated in a narrow gorge at the

junction of two mountain streams. There are seven hot sulphur springs, used mainly for drinking, and considered of special efficacy for throat diseases and tuberculosis. The place contains a number of fine hotels and is visited annually by about 6000 guests. Permanent population, 1901, 768; 1911, 622. A short distance away is Eaux-Chaudes, with sulphur springs.

**EAUX-CHAUDES**, shôd'. See **EAUX-BONNES**.

**EAVESDROPPING**, or **EAVESDRIP**. In the law of real property, the right to permit rain-water falling upon one's roof to drop from the eaves upon the adjoining land of another. This is not a natural right inhering in lands, like the right of lateral support, but is an easement, which may, like the easement of ancient lights, be acquired by prescription or immemorial user or by grant. It is a variety of the easement of drainage. The right is not lost by changes in the roof or in the height of the house to which it attaches, so long as the drip from the eaves is not thereby substantially increased or otherwise varied. It was recognized at the Roman law as the urban servitude of *stillicidium*. See **DRAINAGE**; **EASEMENT**; **SERVITUDE**.

The term "eavesdropping" is also employed in a derivative sense in the criminal law of England and the United States to describe a form of nuisance, punishable as a misdemeanor (q.v.). It consists in secretly loitering about a building with intent to overhear or see what is going on inside and to repeat and publish it to the annoyance, vexation, or injury of others. See the authorities referred to under **CRIMINAL LAW** and the statutes of the several States.

**EAVES SWALLOW**, **CLIFF SWALLOW**, or **REPUBLICAN SWALLOW**. See **BARN SWALLOW**.

**EBAL**, ê'bâl, and **GERIZIM**, gër'i-zim. Two mountains of Palestine significant in Hebrew tradition in connection with the blessing and cursing of the people (Deut. xi. 29, xxvii. 11-26; Josh. viii. 33-34). They are situated in central Samaria, separated by a narrow valley about 600 feet wide, in which stands the town of Nablus (Neapolis), which is still the metropolis of the Samaritans (Map: Palestine, C 3). They rise to an elevation of 3077 feet and 2849 feet respectively and are known at the present day as Jebel Sulemiyeh and Jebel el-Tur. The Samaritans erected a temple on Mount Gerizim, probably in the fourth century B.C. It was destroyed by John Hyrcanus in 129 B.C., but the mountain continued to be held sacred. A rivalry between the Jerusalem and the Samaritan cults is a feature of Jewish history and continues to the days of Jesus. The Samaritan text of Deut. xxvii. 4-8 is thought by many to reflect this controversy. The Hebrew text preserved by the Jews enjoins the building of an altar to Yahweh on Mount Ebal and the placing there of large stones inscribed with the law. This injunction, according to the Hebrew text preserved by the Samaritans, refers to Gerizim. Two explanations of the discrepancy are possible. Either the Jewish text is correct and the Samaritan an intentional alteration to justify the building of the temple on Gerizim, or the Samaritan is correct and the Jewish an early change to deprive this temple of its scriptural support. The former view is generally held by modern scholars, but there is much to be said in favor of the latter. If the law which the Samaritans recognized ordained



the construction of a sanctuary on Mount Ebal, it is difficult to see why they should deliberately have chosen the other mountain; while it is quite apparent why the mention of Gerizim as a spot divinely selected for a sanctuary in a book that never refers to Jerusalem by name should have caused a Jewish scribe to correct it as an error. In either case the injunction is singularly out of harmony with the centralizing tendency of the code and seems to point to a firmly rooted tradition. It was to Gerizim and the controversy between Jews and Samaritans concerning its sanctity that the "woman of Samaria" referred in her conversation with Jesus (John iv. 20, 21). The Samaritans claim that Gerizim was the scene of the attempted sacrifice of Isaac (Gen. xxii), and on this mount they still perform the yearly paschal sacrifice. See SAMARITANS.

**EBB.** See TIME.

**EBBON**, ɛb'bɔn (775-851). A French archbishop. He was the foster brother of Louis le Débonnaire, son of Charlemagne, and was created Archbishop of Rheims by that prince. He made three voyages to Denmark and helped to establish Christianity there. When Lothaire revolted against his father, the Archbishop took his part. Upon the King's return to power Ebbon fell into disgrace, and it was not until Lothaire became Emperor that he attempted to regain his bishopric. The Pope refused to reinstate him, and he took refuge with Louis of Bavaria and was made by him Bishop of Hildesheim in Saxony.

**EBBW VALE**, ɛb'bɔv vāl. An urban district of Monmouthshire, England, about 9 miles west-southwest of Abergavenny. It is situated near the source of the Ebbw River, in a mountain wilderness of about 1000 feet altitude. The district produces much iron and steel. Pop., 1901, 20,994; 1911, 30,559.

**EBE**, ɛ'be, GUSTAV (1834- ). A German architect, born at Halberstadt. He studied in Berlin and then traveled in France and Italy. In company with Julius Benda, with whom he was associated in Berlin, he executed plans for the Vienna Rathaus, which obtained the first prize in competition, but were not executed. He was later active in Berlin, where he designed numerous structures, including the Tiele-Winckler Palace (the headquarters of the Spanish embassy) and the Apollo Theatre. He is also the author of a work on art, *Die Spätrenaissance* (1886), a history of European art from the middle of the sixteenth century to the end of the eighteenth; *Die Schmuckformen der Denkmalsbauten aus allen Stilepochen seit der griechischen Antike* (8 vols., 1893-97); *Der deutsche Cicerone: Führer durch die Kunstschatze der Länder deutscher Zunge* (4 vols., 1897-1901); *Architektonische Raumlehre* (2 vols., 1900-01); *August Orth* (1904).

**EBEL**, ɛ'bel, HERMANN WILHELM (1820-75). A German Celtic scholar. He was born in Berlin, was educated at Halle, and was a member of the philological faculty of the Berlin University from 1872 to 1875. He was the foremost authority on Celtic philosophy in Germany, and his researches on the grammatical construction and lexicography of Irish, Manx, Welsh, Cornish, Breton, and ancient Gaelic gave him a permanent place in the field of philology. Besides his principal work, a new and improved edition of Zeuss's *Grammatica Celtica* (1871), he published: *Die Lehnwörter der deutschen* (1856); *De Verbi Britannici Futuro ac Con-*

*junctivo* (1866; partly translated into English by W. K. Sullivan under the title *Celtic Studies*); *De Zeusii Curis Positis in Grammatica Celtica* (1869).

**EBEL**, JOHANNES WILHELM (1784-1861). A German Protestant clergyman, born at Passenheim, East Prussia. As pastor at Königsberg, he became the founder of a mystical philosophical society which counted among its members many representatives of the nobility. Accusations of gross immorality caused a judicial investigation of the society, with the result that it was dissolved and its organizer removed from office (1839). A subsequent investigation, however, showed that the charges of secret vice, disturbance of domestic peace, and pious fraud brought against the members of the association were not proved. Consult Mombert, *Faith Victorious: Being an Account of the Life and Times of Dr. Johannes Ebel* (London, 1882).

**EBEL**, JOHANN GOTTFRIED (1764-1830). A German writer on geography, born at Züllichau, Prussian Silesia, and educated at the University of Frankfurt-on-the-Oder. His translation of the works of Sieyès, and his close association with certain revolutionary leaders of France, made him unpopular with the authorities of Frankfurt-on-the-Main, and in 1796 he was banished from that city, where he had begun a medical practice. He subsequently lived in Paris and in Zurich, where his services in behalf of the maintenance of the Swiss Republic, which was endangered by the prevailing political conditions, were rewarded by an offer of citizenship on the part of the municipality of Zurich, in which city he spent the last years of his life. His principal works are the following: *Anleitung auf die nützlichste Art die Schweiz zu bereisen* (2 vols., 1793; 8th ed., 1842); *Schilderungen der Gebirgsvölker der Schweiz* (2 vols., 1798-1802); *Ueber den Bau der Erde in den Alpengebirgen* (2 vols., 1808). Consult Escher, *Johann Gottfried Ebel* (Trogen, 1835).

**EBELING**, ɛ'be-ling, ADOLF (1827-96). A German author, born in Hamburg. He studied at the University of Heidelberg and became a professor in the Imperial School of Commerce in Paris. In 1870 he returned to Germany and edited for a time the *Düsseldorf Deutsches Künstleralbum*. From 1874 to 1878 he was a professor in the military school at Cairo. His publications include: *Bruchstücke aus der Beschreibung einer Reise nach Brasilien* (1849); *Bilder aus Kairo* (1878); *Memoiren über Napoleon I und seinen Hof* (4 vols., 1880-87); *Napoleon III und sein Hof* (1891-93).

**EBELING**, CHRISTOPHER DANIEL (1741-1817). A German scholar, born in Hildesheim. He early devoted himself to geographical studies. The Congress of the United States gave him a vote of thanks for his great work, *The History and Geography of North America* (5 vols., Hamburg, 1794-1816). While preparing this work, he made a collection of about 4000 books and 10,000 maps, which was purchased in 1818 by Israel Thorndike and presented to Harvard University.

**EB'ENEZER** (Heb., *Eben-ha'ezer*, the stone of help). The name of a place marked by a monumental stone set up by Samuel in recognition of divine assistance in a battle with the Philistines (1 Sam. vii. 10-12). Two earlier battles were fought at this place between the Israelites and the Philistines, in both of which the Israelites were beaten, and in the second of

which the Ark of the Covenant was captured (1 Sam. iv. 1-2, 3-11). The location of the place cannot be satisfactorily determined.

**EBENSBURG**, ẽbenz-bũrg. A borough and the county seat of Cambria Co., Pa., 16 miles (direct) west of Altoona, on the Pennsylvania Railroad (Map: Pennsylvania, D 6). It is situated in the Alleghenies, about 2025 feet above sea level and is a resort. Ebensburg is in a rich bituminous coal region and has saw mills, tanneries, woolen mills, a foundry, etc. Pop., 1900, 1574; 1910, 1978.

**EBER.** See HEBREWS.

**EBERHARD**, ẽbẽr-hãrt, surnamed **IM BART** (1445-96). The fifth Count and first Duke of Württemberg. He was the son of Count Louis the Elder and succeeded his brother at the age of 12; at 14 he wrested the government from his uncle Ulrich, who had been appointed his guardian. He paid no attention to government affairs, but indulged his passions and led a dissipated life. In 1468 he made a pilgrimage to Jerusalem, after which he abandoned his reckless mode of living and ruled well. He married Barbara of Mantua, whose influence over him contributed largely to the elevation of his character. He began to study, gathering around him men of learning, and founded, in 1477, the University of Tübingen. In 1482 Eberhard, by the Treaty of Münnigen, put an end to the division of his principality, made in 1437 between his father and his uncle Ulrich as representatives of the two lines of Urach and Stuttgart. By this treaty he secured the future integrity of Württemberg and established the right of primogeniture in his own family; he became at the same time the founder of the representative constitution of Württemberg. He made Stuttgart his place of residence and improved the conditions of the convents in his territories. Although he preferred peace, he was an able warrior. His courage and his fidelity to his engagements secured the esteem and friendship of the emperors Frederick III and Maximilian I. In recognition of his services the latter, in 1495, raised Eberhard to the dignity of Duke, confirming at the same time all the possessions and prerogatives of his house. He died Feb. 24, 1496. Consult Bossert, *Eberhard im Bart* (Stuttgart, 1884).

**EBERHARD**, CHRISTIAN AUGUST GOTTLÖB (1769-1845). A facile German poet and romancer, with a leaning to the older poets of the eighteenth century, born at Belzig. The more noteworthy of his many works are the often reprinted idyl, *Hannchen und die Küchlein* (1822), still popular with the young, and *Der erste Mensch und die Erde* (1828).

**EBERHARD**, JOHANN AUGUST (1739-1809). A German philosophical writer. He was born at Halberstadt, studied theology at Halle from 1756 to 1759, and after spending several years as a preacher in Berlin and Göttingen became professor of philosophy at Halle in 1775. Among his writings were treatises on ethics, æsthetics, the history of philosophy, and synonymy; especially notable were the *Neue Apologie des Sokrates* (1772-73) and *Allgemeine Theorie des Denkens und Empfindens* (1776). He was a Leibnitzian and towards the close of his life struggled, but without success, against the speculative views of the new schools of philosophy headed by Kant and Fichte.

**EBERLE**, ẽbẽr-le, ROBERT (1815-60). A German animal and landscape painter, born at Meersburg on Lake Constance. At first a pupil

of Jakob Biedermann at Constance, he went to Munich in 1830, where he was much influenced by the works of Ruysdael and Dujardin in the Pinakothek. In 1848 he spent three months in America, but he returned to Munich, where he died from the effects of an accidental pistol shot. He is particularly noted as a painter of sheep. His pictures are distinguished for good drawing and striking light effects. Among the most noteworthy are: "Shepherd Killed by Lightning beside his Flock" (1842), Copenhagen Gallery; "Sheep and Cattle in Stable," Leipzig Museum; "Suabian Shepherd with flock," (1851), Pinakothek, Munich; "Sheep Driven over Precipice by an Eagle" (1858), Karlsruhe Gallery.—His son ADOLF (1843- ), born in Munich, is equally successful as a genre and animal painter. He studied at the Munich Academy, especially under Piloty. One of his best rural genre scenes, the "Seizure of the Last Cow" (1861), is in the Munich Gallery. Others are: "After the Rain" (1868), for which he was awarded a medal in Vienna; "The First Deer" (1879); "Forester's Belated Dinner" (1888); "A Lucky Catch" (1891).

**EBERLEIN**, ẽbẽr-lĩn, GUSTAV (1847- ). A German sculptor, born at Spiekershausen (Hanover). He studied at the Art Academy of Nuremberg and at Berlin under Blaaser, a pupil of Rauch. After a short sojourn in Rome he returned to Berlin and allied himself with the so-called realistic group of sculptors, of which Reinhold Begas (q.v.) is the chief representative. In his work temperament and ability are united with a strong feeling for decorative effects; his ideal statues seek to combine the forms of ancient art with modern sentiment. Good examples of the latter are "Boy Extracting a Thorn" (National Gallery, Berlin), with which he first made a name; "Greek Flute Player," and "The Secret." He also carved a number of religious pieces, prominent among which are groups depicting the life of Adam and Eve; while among his decorative works the frieze of the Berlin Ministry of Public Instruction, containing 50 life-size figures, deserves mention. But Eberlein's reputation rests chiefly upon his public monuments, such as those of Emperor William I at Elberfeld, Mannheim, Altoona, and Ruhrort; Bismarck at Krefeld, Richard Wagner in Berlin, and Goethe in Rome; and the heroic statues of Queen Louise at Tilsit, and King Frederick I and Frederick William III in Berlin. He published in 1892 *Aus eines Bildners Seelenleben, Plastik, Malerei und Poesie*. Consult Rosenberg, *Eberlein* (Bielefeld, 1903).

**EBERNBURG**, ẽbẽrn-böörk. A village in the Bavarian Palatinate, situated at the junction of the Alsenz with the Nahe, 20 miles southwest of Mainz (Map: Germany, C 4). It is notable on account of its castle, built on the site of an ancient one, which once belonged to the famous knight Franz von Sickingen, friend of the early Reformers. His stronghold sheltered Melanchthon, Schwebel, Bucer, Ecolampadius, and also Ulrich von Hutten, the most distinguished bard of the Reformation and apostle of German unity. Hutten composed several of his works here. The castle was destroyed by the French in 1794 and rebuilt in 1841. The Hutten-Sickingen Monument, halfway up the hill, was unveiled in 1889. Pop., about 800. Consult Schneegans, *Die Ebernburg* (Kreuznach, 1888).

**EBERS**, ẽbẽrs, EMIL (1807-84). A German

genre painter, born in Breslau. He was a pupil of the Düsseldorf Academy, where he was much influenced by J. J. Schwan, and Ritter. In company with . . . two he visited the coasts of Holland and Normandy and became much interested in the life of smugglers, fishermen, and sailors, from which the subjects of his best pictures are chosen. He also painted humorous military scenes. His works show good composition, careful study of detail, and harmonious coloring. The most noteworthy are: "Smugglers about to Land" (1830), National Gallery, Berlin; "Rescued Woman among Fishermen" (1841); "Pilot Boat" (1845); "Mutiny on a Brig" (1848), Breslau Museum.

**EBERS, GEORG MORITZ** (1837-98). A German Egyptologist and novelist, born in Berlin. In 1856 he entered the University of Göttingen as a student of law, but soon became interested in Egyptology and devoted himself to that study in Berlin under Lepsius. Brugsch, and Boeckh. Receiving his degree in 1862, he spent the next three years at work in the principal Egyptological museums of Europe. In 1865 he became lecturer and in 1869 associate professor of Egyptology at Jena. In 1869 and 1870 he traveled extensively in Egypt and Nubia and in the latter year accepted a call to Leipzig as associate professor. Two years later he again visited Egypt, where he discovered the celebrated hieratic medical papyrus, since known as the *Papyrus Ebers*. Dating from about 1550 B.C., it is one of the best-preserved Egyptian papyri in existence and forms the chief source of information in regard to the medical knowledge of the ancient Egyptians. A facsimile (110 plates) was published in 1875 by the discoverer, with an introduction written by himself and a hieroglyphic-Latin glossary by L. Stern. The papyrus is now in the library of the University of Leipzig. Among Ebers's scientific works may be mentioned his *Disquisitiones de Dynastia XXVI Regum Aegyptiorum* (1865) and *Aegypten und die Bücher Moses* (1868). His *Durch Gosen zum Sinai* (1872; 2d ed., 1881) is partly of a popular character. He also wrote *Aegypten in Wort und Bild* (2 vols., illustrated, 2d ed., 1880), and *Richard Lepsius, ein Lebensbild* (1885). Ebers's reputation as a novelist was established by his *Eine ägyptische Königstochter* (1864), a charming picture of Egyptian life at the time of the Persian conquest. Of his later novels, *Uarda* (1877), *Homo Sum* (1878), *Die Schwestern* (1879), *Der Kaiser* (1881), and *Serapis* (1885) deal with periods of Egyptian history. Others of his novels, among them *Die Frau Bürgermeisterin* (1881), *Ein Wort* (1882), and *Die Gred* (1887), are located either in Holland or South Germany in the sixteenth century, while his *Eine Frage* (1881) is an idyl of ancient Greek life. In 1887 he brought out his novel *Die Nilbraut* and in 1894 *Kleopatra*. In 1876 Ebers became partially paralyzed and for the rest of his life suffered from continued ill health. He usually spent the summer at his country place at Tutzing, near Munich, and there he died. An excellent sketch of Ebers by the historian Eduard Meyer is to be found in *Biographisches Jahrbuch und deutscher Nekrolog*, vol. iii (Berlin, 1898). His own *Die Geschichte meines Lebens* (Stuttgart, 1893) should also be consulted.

**EBERSWALDE**, ä'bërs-väl'de. A town and health resort of the Prussian Province of Brandenburg, situated on the Finow Canal, at its

junction with the Schwärze, about 27 miles north-northeast of Berlin (Map: Prussia, E 2). It has a forestry school, a gymnasium, and schools of domestic economy, and is a favorite summer resort on account of its delightful situation in the midst of fine groves and pine forests. It has mineral springs. It is an industrial centre, having extensive manufactures of railway cars and locomotives, horseshoe nails, roofing, felt, and cement. There is considerable trade in coal, wood, and grain. Near by are large brass foundries and a government mill at which paper is made for bank notes. Pop. 1900, 21,619; 1905, 23,846; 1910, 26,064.

**EBERT, a'bërt, ADOLF** (1820-90). A German philologist, born at Cassel. He studied at Marburg, Leipzig, Göttingen, and Berlin, became professor at Marburg, and in 1862 professor of Romance philology at Leipzig. From 1862 to 1873 he also held the chair of English philology. His most important work is his *Allgemeine Geschichte der Litteratur des Mittelalters im Abendlande* (3 vols., 1874-87; Fr. trans. by Aymeric and Condamin, Paris, 1883-89). In 1859 he established with Ferdinand Wolf the *Jahrbuch für romanische und englische Litteratur*, to the first five volumes of which he contributed. His study was directed chiefly towards an examination of the connection between the Romance literature of the Middle Ages and the Latin and German literature of the same period. Among his publications may be mentioned: *Quellenforschung aus Geschichte Spaniens* (Kassel, 1849); *Handbuch der italienischen National-Litteratur* (Marburg, 1854); *Geschichte der christlich-lateinischen Litteratur von ihren Anfängen bis zum Zeitalter Karls des Grossen* (Leipzig, 1874).

**EBERT, KARL EGON** (1801-82). An Austrian poet, of the school of A. Grün and Lenau. He was born at Prague and was educated there and at Vienna, and after filling several positions settled in Prague. His chief works are his *Dichtungen* (1824; 3d ed., 1845); *Wlasta, ein böhmisch-nationales Heldendicht in drei Büchern*, a true epic, but perhaps too rhetorical; *Das Kloster, idyllische Erzählung in fünf Gesängen* (1833), one of his best works, plainly under the influence of Goethe's *Hermann und Dorothea*; the dramatic poem, *Bretislav und Jutta* (1835); a collection of sonnets entitled *Ein Denkmal für Karl Egon, Fürsten von Fürstenberg* (the poet's godfather) (1855); and the didactic poem *Fromme Gedanken eines weltlichen Mannes* (1859). He likewise wrote a large number of dramas, of which *Das Gelübde* was the best. His best work was in the field of the lyric and the ballad. His poetical works were published in 7 vols. (1877).

**EBERTH, a'bërt, KARL JOSEF** (1835- ). A German bacteriologist and anatomist. He was born at Würzburg, studied at the University there, became professor of pathological anatomy at Zurich in 1865, and in 1881 was called to a similar chair at Halle. The results of his anatomical researches, including "Ueber den Peitschenwurm" (1859) and "Ueber Nematoden" (1863), appeared chiefly in Rudolph Virchow's *Archiv für pathologische Anatomie*. His investigations as a bacteriologist have to do principally with the bacillus of typhoid fever. His writings include: *Die Untersuchung des Ausswurfs auf Tuberkelbazillen* (1891); *Die Thrombose, with Schimmelbusch* (1888); *Mikroskopischer Technik* (1900).

**EBING, RICHARD, BARON VON KRAFFT.** See KRAFFT-EBING.

**EBINGEN, ă'bing-en.** A town in the Black Forest district of Württemberg, Germany, 37 miles south of Tübingen by rail, situated amid beautiful hill scenery (Map: Germany, C 4). It has manufactures of woollens, clothing, velvet, stockings, hats, and leather. Pop., 1900, 9001; 1910, 11,423.

**EBIONITES, ă'bi-ô-nīts** (Lat. *Ebionitæ*, from Heb. *'ebyonim*, poor). A name employed, because of its Hebrew origin, to designate Christians of Jewish blood. Still later, when Jewish Christians had separated from the great body of the Church and displayed heretical tendencies, the name was applied to them. Isolated as they now were, they fell into a number of sectarian divisions, to one of which in particular the term was sometimes confined (in distinction from a more moderate sect called the Nazarenes). Irenæus describes the Ebionites as Jewish Christians who hold to the Mosaic law, reject Paul as an apostate, deny the miraculous birth, and regard Christ as a mere man. Origen styled all Jewish Christians Ebionites and distinguished two classes, one of which accepted and the other denied the virgin birth. The most detailed accounts are found in Epiphanius, *Against Heretics*. They lingered in Palestine and Syria till the fifth century, but were few and unimportant after the second. Consult Harnack, *History of Dogma* (Boston, 1894-1900), and Rainy, *The Ancient Catholic Church* (New York, 1902). See CLEMENT OF ALEXANDRIA; ESSENES; OLD CATHOLICS.

**EBLIS.** See IBLIS.

**EBNER-ESCHENBACH, ăb'nēr ăsh'en-băg, MARIE, BARONESS VON** (1830- ). A distinguished Austrian novelist. Born at Castle Zdislawitz, Moravia, her maiden title being Countess Dubsky, she married, in 1848, an Austrian officer, who died in 1898. She lived alternately at her birthplace and in Vienna. Her first publications are dramas now unimportant. Her fiction, which attracted immediate attention, begins with *Erzählungen* (1875). This was followed by: *Božena* (1876); *Neue Erzählungen* (1878); *Dorf- und Schlossgeschichten* (1884); *Zwei Comtessen* (1885; Eng. trans.); *Neue Dorf- und Schlossgeschichten* (1886); *Das Gemeindegeld* (1887; Eng. trans.); *Lotti die Uhrmacherin* (1889); *Ein kleiner Roman* (1889); *Miterlebtes* (1890); *Unsühnbar* (1890; Eng. trans.); *Margarete* (1891); *Drei Novellen* (1892); *Glaubenslos* (1893); *Das Schädliche* and *Die Totenmacht* (1894); *Rittmeister Brand* and *Bertram Vogelweid* (1896); *Alte Schule* (1897); *Aus Spätherbsttagen* (1901); *Agave* (1903); *Die arme Kleine* (1904); *Die unsiegbare Macht* (1905); *Meine Kinderjahre* (1906); *Ein Buch für die Jugend* (1907); *Volksbuch* (1909); *Altweibersommer* (1909); *Genrebilder* (1910). Among her dramatic works are: *Dr. Ritter* (1872); *Ohne Liebe* (1891); *Am Ende* (1897). She wrote also a popular collection of *Aphorismen* (1880) and verses collected as *Parabeln, Märchen und Gedichte* (1892). Her collected works were published in 1893-1911. Her work is distinguished for its power of description, its psychological insight, its humor, wit, and polished precision of style. Her sense of proportion in novelistic construction has also been highly praised. For her biography, consult Necker (Berlin, 1900) and Bettelheim (ib., 1900).

**EBOLI, ă'bô-lă** (Lat. *Ebura* or *Eburum*). A

city of Campania, in South Italy, 50 miles southeast of Naples (Map: Italy, K 7). It is picturesquely situated on a hill above the river Sele, a few miles from the Gulf of Salerno. Pop., 1901, 12,407; 1911, 12,741.

**EBOLI, ANNA DE MENDOZA DE LA CERDA, PRINCESS OF** (1540-92). A Spanish courtier, with the further titles of Duchess of Francavilla and Princess of Melito. She was a prominent and influential figure at the court of Philip II of Spain and played a conspicuous rôle in many of the intrigues of the time. She was the wife of that proud old nobleman Ruy Gómez de Silva, Prince of Eboli and one of the most trusted advisers of Philip II, and she became the mistress of Philip II and of his favorite the traitor Antonio Pérez, carrying on the intrigue with sovereign and favorite at the same time. She is best known as a character in Schiller's drama *Don Carlos*, and more recently she appeared in Marion Crawford's novel *In the Palace of the King*, where her rôle accords better with the known facts of history.

**EB'ONY** (older form *ebon*, OF. *ebene*, Lat. *ebenus*, Gk. *ēperos*, *ebenos*, *ebony*; probably of Sem. origin; cf. Heb. pl. *hăbîm*, *ebony*, lit. dark, ultimately probably of Egyptian origin). The hard, heavy, and dark-colored heartwood of a number of species of trees. The genus *Diospyros*, of the family Ebenaceæ, is the source of most of the ebony of commerce. The best quality is obtained from *Diospyros ebenum*, a large tree of India, Ceylon, and other tropical countries. Logs of ebony of this species, 10 to 15 feet in length, with the heartwood 2 feet in diameter, are common. Ebony of good quality is obtained in Coromandel from *Diospyros melanoxylon* and also from *Diospyros tomentosa* and other species of India, Madagascar, and Mauritius. The Calamander wood is from *Diospyros hirsuta*; the "black wood" is a peculiar kind of wood. The effect obtained from *Diospyros ebenum*. Ebony is furnished by *Maba ebenus* of Molucca and by a number of trees of the family Leguminosæ. Among these latter may be mentioned a variety obtained in Abyssinia from *Milletia* and the West Indian ebony (*Brya ebenus*). The American species of *Diospyros* (*Diospyros virginiana* and *Diospyros texana*) often supply a fairly good quality of ebony. The wood is chiefly used as a veneer by cabinetmakers. It is very heavy and takes a high polish. The beauties of this wood were well known to the Greeks and Romans, who inlaid it with ivory for contrast. It is mentioned in the Scriptures as an article of Tyrian importation. The wood is somewhat pungent and was once thought to have medicinal value. Ebony is exported in considerable quantity from Egypt, Zanzibar, Madagascar, Mauritius, Ceylon, India, and Jamaica. What is known as bastard ebony is exported in considerable quantities from Brazil. It is produced by the tree *Jacaranda ovalifolia*. True ebony wood is so intensely dark in color that the term "black as ebony" is a well-known colloquialism. Imports into the United States in 1913, \$90,133. See JACARANDA WOOD.

**EBONY, MOUNTAIN.** See BAUHINIA.

**EBORA.** See EVORA.

**EBOR'ACUM.** See YORK.

**EBERARD, ă'brărt, JOHANNES HEINRICH AUGUST** (1818-88). A German Reformed theologian and miscellaneous writer. He was born at Erlangen, Jan. 18, 1818. He studied there and at Berlin, became professor at Zurich in

1844, at Erlangen in 1847, removed to Speyer in 1853, but in 1861 returned to Erlangen and resumed his lectures. From 1875 he was pastor of the French Reformed church at Erlangen. He was a voluminous writer both in theology and lighter literature. Those of his theological works translated into English include *The Gospel History* (1863) and *Apologetics* (1886-87). He also published: *Die iro-schottische Missionskirche des sechsten bis achten Jahrhunderts* (1873); *Bonifatius, der Zerstörer des columbanischen Kirchentums auf dem Festlande* (1882); *Lebensführungen* (1888); *Christliche Dogmatik* (1851); commentaries on Hebrews and Revelation; and many dramas, poems, etc. When writing upon nontheological subjects, he generally used a pseudonym—Christian Deutsch, Gottfried Flammberg, or Siegmund Sturm. He died at Erlangen, July 23, 1888.

**EBRO** (Lat. *Iberus*). One of the largest rivers of Spain, rising in the Province of Santander, in the north-central part of the country, on the south slope of the Cantabrian Mountains (Map: Spain, E 2). After a tortuous course in a southeasterly direction of about 450 miles, it empties into the Mediterranean at Cabo de Tortosa. It drains an area of about 30,000 square miles and has a delta which extends far into the sea. Its mouth is choked up with sand, and, to render it navigable, a canal called the San Carlos has been carried through the south side of the delta. Its principal affluents are the Najerilla, Jalón, Huerva, and Guadalepe from the right, and the Aragon, Gallego, and Segre from the left, which drain the south slopes of the Pyrenees. The large supply of water brought to it by the Aragon and Segre renders the Ebro particularly advantageous for irrigating the lowlands of Aragon. The course of the Ebro is chiefly through narrow and sometimes rocky valleys; its bed is characterized by many shoals and rapids which interrupt the navigation. This is partly remedied, however, by means of the Imperial Canal, which extends from the vicinity of Tudela to a point 40 miles below Saragossa, the principal city on the river.

**EBSTEIN**, ēp'stĭn, WILHELM (1836-1912). A German physician, born at Jauer, Silesia. He was educated at Breslau and Berlin and in 1874 became professor of medicine at the University of Göttingen and director of the Medical Polyclinical Institute at that institution, and from 1877 to 1906 he was at the head of the medical clinic. His writings, several of which contain valuable suggestions as to dietetic cures, include: "Nierenkrankheiten," vol. ix of Ziemssen's *Handbuch* (2d ed., 1878); *Die Fettleibigkeit (Korpulenz) und ihre Behandlung nach physiologischen Grundsätzen* (7th ed., 1887); *Die Kunst das menschliche Leben zu verlängern* (1891); *Lebensweise der Zuckerkranken* (2d ed., 1898); *Handbuch der praktischen Medizin*, with Dr. Julius Schwalbe (1898); *Die Medizin im Alten Testament* (1901); *Die Medizin im Neuen Testament und im Talmud* (1903); *Die Pathologie und Therapie der Lepra* (1909).

**EBULLIOSCOPE** (Lat. *ebullire*, to boil, from *e-*, out + *bullire*, to bubble, from *bullā*, bubble + Gk. *σκοπεῖν*, *slopein*, to look). An apparatus for ascertaining the boiling temperature of liquids, such as distilled liquors, and more especially for observing the changes of boiling temperature caused by dissolving comparatively nonvolatile substances in a given liquid. The best-known ebullioscope is that devised by

Beckmann. It is used mainly for determining the molecular weights of soluble substances, the principle involved being that the elevation of the boiling point of a liquid caused by dissolving in it, say, 1 gram of a given substance, is inversely proportional to the molecular weight of the substance. Concerning the theory and practice of ebullioscopic determination of molecular weights, consult Rosanoff and Dunphy, in the *Journal of the American Chemical Society* for 1914. See MOLECULES—MOLECULAR WEIGHTS.

**EBULLITION**, or BOILING. See HEAT.

**EBURA**, or **EBURUM**. See EBOLI.

**EÇA DE QUEIROZ**, a'si dā kā'ê-rôsh, JOSÉ MARIA (1845-1900). A Portuguese author, born at Povoá do Varzim. He was educated at the University of Coimbra, was a collaborator on the staff of *As Farpas*, a critical journal, in 1871, and was appointed Consul successively at Havana, Newcastle, Bristol, and Paris. His best-known publications are his works of prose fiction, *O crime do Padre Amaro* (1874; thoroughly rewritten and revised edition, 1880), *O primo Basílio* (1877; in French translation by Rattazzi-Ruth, German by C. and H. Michaelis), and *4 Relíquias* (1886; 2d ed., 1891), together with his short stories. The best of the latter, *O Defunto*, was done into excellent English, under the title of *Our Lady of the Pillar*, by Edgar Prestage (London, 1906), with a brief introduction, and a frontispiece showing the beautiful monument erected to Queiroz in Lisbon by the devotion and friendship of the Conde de Arnoso and other admirers. Prestage had previously translated and published, with a critical preface, *A Suave Milagre*, which has already gone through three editions in England and one in America, as *The Sweet Miracle*. An unsatisfactory English rendering of *O primo Basílio* appeared in Boston (1889) under the title *Dragon's Teeth*. Consult the series of essays by J. Pereira de Sampaio (Bruno) entitled *A Geração Nova* (Porto, 1886), and the number for Nov. 20, 1897, of the *Revista Moderna*, which was entirely devoted to Queiroz. Batalha Reis gives reminiscences of Eça's early days, in his preface to some prose fragments that he edited under the title of *Prosas Barbas* (Porto, 1903).

**ECARDINES**. See BRACHIPODA.

**ÉCARTÉ**, ā'kār'tā' (Fr., discarded, p.p. of *écarter*, to discard, from Lat. *ex*, out + *charta*, Gk. *χάρτης*, *chartēs*, paper). A game of cards usually played by two persons, though, in the form called pool écarté, three or even more may take part in it. In this case the third player takes the place of the loser in the first game, and the pool accumulates until one player wins two (or three) games in succession. In French écarté bystanders are permitted to advise, and the player losing leaves the table, his adviser taking his place. If, however, the loser is playing *la chouette* (i.e., taking all bets offered), he need not retire on losing. The sixes, fives, fours, threes, and twos are removed from a pack, and the player cutting highest deals. He gives five cards, by two and three at a time, to his opponent and himself and turns up the eleventh card for trumps. The trump card, if a king, counts one for the dealer. His adversary, if satisfied with his hand, plays; if not satisfied, proposes, which means, briefly, that he wishes to get rid of poor cards and take up others from the stock, and the dealer can accept or refuse.

Should he accept, each may discard, face downward, as many cards as he may choose, receiving fresh ones from the cards yet undealt, these being given first to the nondealer till his hand is complete. A second proposal and a third may be made, and so on till the player is satisfied; but if the dealer refuse, the hand must be played without discarding. The king of trumps scores one if in either hand. The nondealer, being satisfied with his hand, leads; the dealer follows, and the trick is taken by the highest card or the trump. The king is the highest. The winner of a trick leads to the next. The second player must follow suit and must win the trick if he can. The game is scored by the king, as explained, and the majority of tricks. Three tricks score one for the point; all five tricks won by one player score two for the *vole*. When the nondealer does not propose, or his proposal is refused, and he fails to gain three tricks, the dealer scores two, but no more, even though he win the *vole*. The game is five up. The rules are very complicated and vary in different countries. The game is described at length in *Foster's Complete Hoyle* (New York, 1909), whose compiler says he presents "what appears to be the best French usage." Consult also Cavendish, *Pocket Guide to Ecarté* (London, 1897); *The Laws of Ecarté Adopted by the Turf Club* (ib., 1897).

**ECBAT'ANA** (OPers. *Hangmatāna*, written *Hagmatāna*, probably place of assembly, from *ham*, Skt. *saṃ*, together + *gam*, to come; Babyl. *Agamatanu*, *Agamtanu*, Heb. *Achmētha*, Lat. *Ecbatana*, Gk. *Ἐκβάτανα*, *Ekbatana*, *Ἀγβάτανα*, *Agbatana*). The ancient capital of Media. It was situated at a distance of 12 stadia (about 1½ miles) from Mount Orontes, the modern Elvend. It lay upon a conical hill, crowned by a temple of the sun, and was inclosed by seven concentric walls, the innermost of which was gilded and the next plated with silver; while the rest, in their order outward, were painted orange, blue, scarlet, black, and white. The city is said to have been nearly 30 miles in circumference. Its principal buildings were the citadel—a stronghold of enormous dimensions, where also the archives were kept in which Darius found the edict of Cyrus the Great concerning the rebuilding of the temple at Jerusalem—and the royal palace. The mild climate and the magnificence of its structure singled out Ecbatana as the favorite summer residence, first of the Median, then of the Persian, and lastly of the Parthian monarchs. After the battle of Arbela (331 B.C.) Alexander followed Darius thither and secured immense booty. It was again pillaged by the Seleucids; but such were the riches of this place that Antiochus the Great still found 4000 talents' worth of silver, equivalent to more than \$4,000,000, to carry away. Ecbatana subsequently fell into the hands of the Parthians, and it has since so utterly sunk into decay that its site can no longer be fixed upon with certainty. But nowadays scholars generally agree that the present Hamadan, with the reputed tombs of Mordecai and Esther (see **HAMADAN**), occupies the site of ancient Ecbatana. Excavations on the site would no doubt yield valuable finds in the way of antiquities. There was another Ecbatana in Persia, which was given to the Magi, and a third in Syria, at the foot of Carmel, the present Haifa, where Cambyzes, the son

of Cyrus, died. Consult: Barbier de Meynard, *Dictionnaire géographique de la Perse* (Paris, 1861); De Morgan, *Expédition scientifique en Perse*, vol. iv (1896); Pauly-Wissowa, "Ekbatana," in *Real-Encyclopädie*, vol. v (1905); A. V. W. Jackson, *Persia Past and Present* (New York, 1906); E. Crawshay-Williams, *Across Persia* (New York, 1907).

**ECCARD**, ěk'kärt, JOHANNES (1553-1611). A German composer of church music. He was born at Mühlhausen (Thuringia), was a pupil of Orlando Lasso at Munich, and became assistant conductor in 1583 and chapelmaster in 1599 at Königsberg. In 1608 he was chief conductor of the Elector's chapel in Berlin. His songs, cantatas, and chorales live by reason of their harmony and religious feeling. Among the collection of his songs are *Geistliche Lieder* (1579) and *Preussische Festlieder* (1642, posthumous).

**ECCE HOMO**, ěk'sé hō'mō (Lat., Behold the Man). This expression is derived from the words spoken by Pilate on showing Christ to the multitude (John xix. 5) previous to His being led forth to crucifixion, and is applied to paintings representing Christ bound and crowned with thorns. Among the most celebrated representations of the subject are those by Sodoma in the Pitti Palace (Florence) and the Siena Academy; by Correggio in the National Gallery (London); by Titian in the Scuola di San Rocco (Venice) and the museums of Madrid and Vienna—the latter a very large canvas of almost repellent realism; by Tintoretto in the Munich Gallery and the Scuola di San Rocco; by Guido Reni, whose well-known heads of "Christ Crowned with Thorns" are in the Dresden Gallery, the Louvre, and the National Gallery (London); and by Murillo in the Cadiz Museum, the Prado (Madrid), and the collection of Lord Ashburton (London).

**ECCE HOMO: A STUDY OF THE LIFE AND WORK OF JESUS CHRIST.** A religious work by John Robert Seeley, professor at Cambridge University, England, which appeared anonymously in 1865.

**ECCEN'TRIC** (from Lat. *eccentros*, Gk. *ἑκκεντρος*, *ekkentros*, eccentric, from *ἐκ*, *ek*, out of + *κέντρον*, *kentron*, centre). A mechanical contrivance for obtaining an alternating rectilinear motion from a revolving shaft. It consists of a cylindrical disk, mounted on a revolving shaft with its axis parallel to that of the shaft, but having its centre of figure not in the axis of revolution. It is in effect a crank, whose crank pin is of a diameter greater than that of the shaft which actuates it. The disk has usually a groove on its cylindrical surface, into which fits a metallic hoop or band or strap, to which is attached the eccentric rod which has the alternating linear motion. As the eccentric revolves with the shaft, the strap is alternately forced out and in, thus imparting a to-and-fro motion to the rod. The extent of the rise and fall of the rod is equal to twice the distance between the centres. The eccentric is used where the harmonic motion of the crank and connecting rod is desired, but where the stroke or traverse of the rod must be less than the diameter of the shaft which revolves, or is to take place where crank construction would not be feasible, as in the middle of a long or massive shaft. This adapts it for use in operating valves of steam engines, or for working pumps for feed water or compressing air. See **CRANK**; **STEAM ENGINE**.



**ECCENTRIC**, or **ECCENTRIC CIRCLE**. It was a fundamental doctrine with the ancient astronomers that every heavenly body moved in a circle ("the perfect figure") and at a uniform rate. But some of them appeared to move unsteadily and in other figures than circles. Of course, this was considered a mere deceptive appearance. To explain it, they invented the "eccentric circle." Suppose a body, such as the sun, to move in a circle at a uniform rate. To an observer at the centre of the circle the uniformity of the motion is evident—i.e., the sun is seen to travel through equal angular distances in equal times—but to an observer situated at some point halfway between the centre of the circle and the circumference the angular distances traveled through in equal times appear unequal. If, then, the earth, instead of being at the centre of the sun's orbit, be supposed to occupy a position away from it, the want of regularity in the sun's movements is explained. Accordingly, to reconcile the observed fact with their fundamental doctrine, the ancients placed the earth at a point away from the centre of the sun's supposed orbit. The orbit itself was called "the eccentric" because its centre did not coincide with that of the earth, which was considered to be the centre of the universe.

**ECCENTRICITY**. A mathematical term used in connection with certain curves. The eccentricity of the hyperbola (q.v.) or of the ellipse (q.v.) is the ratio of the distance between the foci to the major diameter of the curve. The modern use of the term, however, extends to all conics, defining it as the ratio of the focal distance of any point on the curve to the distance from the directrix. Regarding the earth's orbit as an ellipse, its eccentricity is approximately 0.01677.

**ECCHELLENSIS**, or **ECHELLENSIS**, *ék-kél-lén'sis*, **ABRAHAM** (?-1664). An Arabic scholar. He was born at Ekehel, or Eckel (whence his name), Syria, near the close of the sixteenth century. He was educated in the Maronite College in Rome and became professor of Arabic and Syriac in the College of the Propagandists and later in the Collège de France. In Paris he assisted for a year (1640-41) in the preparation of Le Jay's Polyglot Bible. He published several Latin translations of Arabic works. He died in Rome, 1664.

**ECCHYMOSES**, *ék'ki-mó'sis* (Neo-Lat., from Gk. *ék, ek*, out of + *χυμός, chymos*, juice, from *χεῖν, chein*, to pour). A discoloration of the surface, produced by blood effused below or in the texture of the skin, as in a black eye or bruise. It is usually attended by swelling to a greater or less extent and is the result of injury. Cutaneous or subcutaneous hemorrhages attend a large number of diseases, particularly the severer types of the exanthemata, and definitely characterize a few such as scurvy and purpura, and they are also produced by certain poisons, e.g., snake venom and mercury. The mucous membranes suffer as well as the skin.

**ECCLEFECHAN**, *ék'l-fäk'an*. A small village of Dumfriesshire, Scotland, 20 miles north of Carlisle (Map: Scotland, E 4). Thomas Carlyle was born and buried there and the village is believed to be the Entepfuhl of his *Sartor Resartus*. Pop., 1911, 1077.

**ECCLES**, *ék'k'iz* (from Lat. *ecclesia*, from Gk. *ἐκκλησία, ekklēsia*, church). A municipal borough of Lancashire, England, picturesquely situated on the Irwell and the Manchester Ship

Canal, about 4 miles west of Manchester, of which it is practically a suburb (Map: England, D 3). It was incorporated in 1892. Its water supply is derived from Manchester and its gas from Salford. The town owns its electric plant and street-railway lines. It maintains public baths, a market, cemetery, and recreation grounds. The chief industries are the manufacture of cotton goods, fustians, gingham, and machinery. Pop., 1901, 34,369; 1911, 41,946.

**ECCLESFIELD**, *ék'k'is-fēld*. A town in the West Riding of Yorkshire, England, 5 miles north of Sheffield. The chief manufacture is cutlery, but linen and nails and tools are also produced. There are coal and iron mines in the vicinity. Pop. (civil parish), 1901, 18,324; 1911, 22,404.

**ECCLESIA**, *ék-klē'zī-ä* (Lat., from Gk. *ἐκκλησία, ekklēsia*, assembly, from *ék, ek*, out + *καλεῖν, kalein*, to call). 1. A term commonly used to denote the popular assembly of the Athenians, in which all free citizens might vote. Its authority was supreme, though ordinarily only those citizens could be present who lived in the immediate vicinity of Athens, and 6000 was regarded as a large attendance. A popular assembly is part of the Greek state in the Homeric poems; its function, however, is rather to ratify the decisions of the chieftains than to initiate legislation or action. At Athens, too, in the early days when the nobles held sway (see *ARCHON*; *ATHENS, History*), such a body, if it existed, was seldom convoked and was of no practical authority. Solon (594 B.C.) first gave to the ecclesia definite form and substance; he made it a power by admitting to it all citizens and giving it some voice in the election of officials and some right to review their actions. With the establishment of the Clisthenian democracy the supremacy of the ecclesia was firmly established. (See *CLISTHENES*.) In the fifth and fourth centuries B.C. the meeting place was the Pnyx (q.v.); in the third century it was the theatre. At first the ecclesia seems to have met only once in each *prytany*, i.e., the period of 35 or 36 days, into 10 of which the Athenian year was divided, but later it met regularly four times in a *prytany*, while extra meetings could be called by the prytanes. The prytanes were the 50 senators of that one of the 10 tribes which at that time was acting as standing committee of the Senate. In the fifth century B.C. the *epistatēs*, or chairman of the prytanes, presided, but later a committee of nine, one from each of the other nine tribes, was chosen as *proedroi* and presided over the meetings. Those who attended the ecclesia received pay probably after 400 B.C., at first one obol, later three oboli, and at last even six or nine. The ecclesia was opened with sacrifice and prayer, and then the business was laid before the assembly in the form of resolutions already adopted by the Senate. These were open to alteration to any extent, but no business might be presented to the assembly before passing the Senate. Any Athenian citizen might speak. The vote was regularly taken by show of hands; only when the decree affected a single individual were ballots used. When the business had been finished, the prytanes dismissed the ecclesia. The decision of the ecclesia, called a *psēphisma*, had full authority of law. (See further *BOULE*; *SOLOON*.) In Sparta, also, there was a popular assembly, called *Apella* (*Ἀπέλλα*), which met once a month, at the time of the full moon, to vote on the proposals of the Council of Ephors.

All full citizens over 30 years of age were at liberty to attend. There was no free debate, and as a rule only the officials seem to have spoken: there was no right to alter the proposals laid before the assembly. It is not known what was the nature of the little *ecclesia* at Sparta mentioned once by Xenophon. The voting at Sparta was by acclamation and not by ballot. The majority was determined by the comparative volume of sound, or, if that was doubted, by a division and counting of the two parties. 2. In the Greek of the New Testament, *ecclesia* is the name for the company of Christ's disciples professing to trust Him as their Saviour and to obey Him as their Lord. It is applied to a small assembly of them, such as were members of one family or could meet in a dwelling house of ordinary size; to the whole number in one city or *polis*; to the whole number on earth; to all that are in heaven; and to the innumerable company on earth and in heaven. It has other meanings, but is usually rendered *Church*.

**ECCLESIASTES**, *ēk-klē'zi-ās'tēz* (Lat., from Gk. *ἐκκλησιαστής*, *ekklēsiastēs*, one concerned with an assembly, from *ἐκκλησία*, *ekklēsia*, assembly). A philosophical book belonging to the third division of the Old Testament collection known as Hagiographa. The Hebrew name is *Koheleth*, which is translated into Greek as *Ecclesiastes*, on the supposition that the Hebrew stem underlying *Koheleth* is to be taken in the sense of assembly, so that *Koheleth* is one who addresses or convenes an assembly, i.e., a preacher. This explanation of the name, however, is doubtful, a strong objection to it being that it does not account for the feminine ending which the Hebrew word exhibits. To assume, as some scholars are inclined to do, that the speaker is "personified wisdom" (and hence the feminine) is not satisfactory, since nowhere is wisdom mentioned as the speaker. Various other explanations have been brought forward, none of which, however, has met with general acceptance. *Koheleth* impresses one as an intentional disguise and therefore a more or less artificial formation, and since *kahal* is a characteristic Hebrew word for "congregation," it is not impossible that by inventing the form *Koheleth* the author intends to carry the idea of anonymity. *Koheleth* would thus be about the equivalent of our "anonymous."

The book itself consists of 12 chapters, forming a series of discourses on the vanity of earthly things, and is put into the mouth of *Koheleth*, who describes himself as "a son of David, king in Jerusalem" (i. 1). Whether Solomon was originally in the mind of the author is not certain, for "son of David" may be an interpolation; but it is probable, for, to the Jews of the postexilic period, to which *Ecclesiastes* belongs, Solomon had become the ideal of a king endowed with wisdom, riches, and power, and who therefore could properly be chosen as an illustration for the central doctrine of the author's philosophy. To prove the theory of the vanity of life it was necessary to choose some one who could represent life in all its manifestations. Solomon was such a man, and the author's argument is that if Solomon came to the conclusion that wisdom, pleasures, riches, power, were all vain, there could be no doubt about it. The introduction of Solomon by implication gave rise to the tradition which ascribed the authorship to Solomon.

This tradition prevented a proper understanding and gave rise to methods of interpretation that disguised the real character of the book, which is undoubtedly skeptical. Everything is questioned—the value of virtue, immortality, divine justice, the providence of God, the advantage of wisdom. The character of the skepticism is peculiarly Oriental. The tone is the same that we find in Omar Khayyam. Yet the influence of Greek thought is unmistakable. It is not only Stoic, but also Epicurean and Heraclitian, speculation with which, though not necessarily through written documents, the author shows acquaintance. The book must belong to a period of depression in the history of the Jews when internal conditions *argued* a doubt as to the validity of the prophetic teachings which had emphasized God's providence for Israel, His justice and goodness, and the necessity of virtue and morality as a condition to securing divine favor and with it happiness. Such a period sets in towards the close of the Persian dominion, and the depression became accentuated from age to age. Hence scholars vary considerably in assigning a date to *Ecclesiastes*; several are inclined to bring the date of the composition down to the days of Herod, while others are inclined to see an allusion to the siege of Syracuse by the Romans in 212 B.C. in iii. 13–18 and consequently place the book about 200 B.C. The language points to a late date. The discovery of the Hebrew text of *Ecclesiasticus* has naturally led to comparisons, and Nöldeke, *Zeitschrift für alttestamentliche Wissenschaft*, pp. 90 ff. (1900), expressed the view that *Ecclesiasticus* is somewhat older. The song of *Youth and Age*, a poem in form as well as in spirit, as Schmidt has shown, is manifestly the work of another man than the original author.

*Ecclesiastes* became a popular book, much to the alarm of pious Jews, who shrank from its skeptical tone and conclusions. Hence the attempt was made to modify its most audacious utterances, to intersperse throughout the book phrases indicative of the author's piety, and above all, by adding a pious conclusion, to give to the book a religious touch. This was done with such success that the skeptical tone was disguised and the book, though not without discussion by the Jewish rabbis, was allowed to remain among the books used in the synagogue and considered as sacred.

Consult the commentaries of Graetz, Delitzsch, Renan, Plumptre, Wright, Hitzig, Ewald, Volck, Nowack, Siegfried, Wildeboer. Zapletal: also Cheyne, *Job and Solomon* (1887); Palm, *Die Kohelet Litteratur* (Mannheim, 1886); Schiffer, *Das Buch Kohelet nach der Auffassung der jüdischen Weisen des Talmuds* (Leipzig, 1884); Bickell, *Koheleths Untersuchungen über den Werth des Daseins* (Innsbruck, 1886); Pfeiderer, *Die Philosophie des Heraklitus von Ephesus und Koheleth* (1886); Dillon, *Skeptics of the Old Testament* (London, 1895); McNeile, *Introduction to Ecclesiastes* (1904); Genung, *Words of Koheleth* (1904); id., *Hebrew Literature of Wisdom* (1906); Barton, *Ecclesiastes* (1908); Haupt, *Koheleth oder Weltschmerz in der Bibel* (1905); Schmidt, *Messages of the Poets* (1911).

**ECCLESIASTICAL COMMISSIONERS FOR ENGLAND.** A corporate body established by act of Parliament, charged with the oversight of the estates belonging to the church.

The commissioners are about 50 in number and include all the bishops of the Established church in England and Wales, the deans of Canterbury, St. Paul's, and Westminster, and five cabinet ministers, in addition to 12 lay members, appointed partly by the crown and partly by the Archbishop of Canterbury. They are required to lay before the crown in council such plans as appear to them best adapted for carrying out the objects of their appointment. By acts subsequent to their organization they now have authority to divide or unite existing parishes and to create additional jurisdictions, known as districts. At the time of their appointment, in order that they might be provided with funds to carry out their plans, the seven best-endowed sees of the Established church were laid under a contribution which amounted to an annual sum of £22,800. In addition to the income thus provided, several canonries in various cathedrals and other ecclesiastical preferments were suppressed, and the entire emoluments were vested in the commissioners.

The commissioners expend their funds on church buildings, on the augmentation of poor livings, and on the endowment of new churches in new cures, called districts; and in so doing, though the fund they handle is a common one, they are bound to consider the needs of the places whence the income is derived. In the augmentation of poor livings the commissioners often contribute a certain sum on condition that the persons interested raise an equal sum. Consult Whitehead, *Church Law* (London, 1892), and Cripps, *Law Relating to the Church and Clergy* (ib., 1886).

**ECCLESIASTICAL CORPORATION.** A body corporate constituted of an ecclesiastical person or persons and subject to ecclesiastical judicatories. Ecclesiastical corporations are divided into corporations aggregate and corporations sole. The former consist of several persons—as, e.g., the head and fellows of a college or the dean and chapter of a cathedral—and are perpetuated by a continuous succession of members. The latter consist of a single person and his successors in a certain office—as, e.g., a bishop or rector. By the law of England the holder of an ecclesiastical benefice is regarded as a corporation. The object of the law in regarding the incumbent of a benefice as a corporation sole is to preserve the temporalities vested in him, which would otherwise descend to his natural heirs. The right of a rector or other corporation sole to church temporalities, although generally spoken of as a freehold in law, is in fact practically nothing more than a tenancy for life. Such a corporation sole is entitled to the full enjoyment of the benefice during his life, but he cannot sell it, and he is even punishable for waste.

The corporation for religious purposes, as it has developed in American law, bears little resemblance to the ecclesiastical corporation of the English law; for while the objects for which they exist are much the same, the American body is purely a civil corporation and subject to the civil tribunals. Of recent years provisions for the creation of ecclesiastical corporations sole have been introduced into the statutes of several States. See CORPORATION; CIVIL CHURCH LAW, AMERICAN.

**ECCLESIASTICAL COSTUME.** See COSTUME, ECCLESIASTICAL.

**ECCLESIASTICAL COURTS.** Tribunals having jurisdiction more especially in causes relating to the discipline of the church and to the discipline of religious persons. The origin is to be found in the first years of Christianity, when the Christians made every effort to settle their disputes among themselves and to maintain their discipline without resorting to the courts presided over by pagan officials. These primitive Christian courts developed around the bishops, who came to take cognizance of all causes, temporal as well as spiritual, among the brethren. Later still, certain matters were assigned to them as proper causes for their especial jurisdiction, such as questions of taxation for the support of religion and matrimonial and testamentary causes. The character and extent of the jurisdiction of ecclesiastical courts must of necessity depend upon the relation subsisting between a state and the religious bodies within it. See ESTABLISHMENTS, ECCLESIASTICAL.

According to the leading authorities in this matter, no separate ecclesiastical courts existed in England before the Norman Conquest, as all causes, both civil and spiritual, were heard in the single county court, in which the bishop and the earl sat together. By a charter of William I a distinction was made between courts civil and courts ecclesiastical, and authority was given to the bishops to hear ecclesiastical causes according to the canon law, which was imported from the Continent. The extent of the jurisdiction of these ecclesiastical courts became a chronic source of dispute between the English crown and the see of Rome, until the jurisdiction of the Bishop of Rome was completely excluded by Henry VIII.

The ecclesiastical courts of England now consist of the following: the Archdeacon's Consistory, Peculiars, Arches Court, and, in cases of appeal only, the Crown in Council. The Public Worship Regulation Act of 1874 created a new ecclesiastical judgeship, having jurisdiction mainly of offenses in matters of ritual. In 1857 the greater part of the ancient jurisdiction of the ecclesiastical courts was taken away, and it is now vested in the Probate, Divorce, and Admiralty divisions of the High Court of Justice. They have, however, still to deal with questions of church government and discipline and changes in church buildings. If they in any manner exceed the limits of their jurisdiction, they are "prohibited" by the High Court of Justice. The power of the ecclesiastical courts over the laity is now practically obsolete. The decrees of these courts are enforced by suspension, deprivation, degradation, and by imprisonment under a writ of *contumace capiendo*. In the Isle of Man the ecclesiastical courts still have, as they formerly had in England, jurisdiction in probate and matrimonial causes. In Scotland the chief ecclesiastical courts have been the General Assembly, the Commissary Court, and the Court of Teinds. The first is the highest tribunal for the consideration of questions of doctrine and discipline according to the Presbyterian usage of the Established church. The courts of the American church bodies are considered under the various denominational titles.

**ECCLESIASTICAL EMBROIDERY.** See EMBROIDERY.

**ECCLESIASTICAL HISTORY.** See CHURCH HISTORY.

**ECCLESIASTICAL LAW.** See CANON LAW.  
**ECCLESIASTICAL TITLES ASSUMP-**

**TION ACT.** An act of the Parliament of Great Britain for the protection of the Established church of England. In the year 1850 an edict was issued by Pope Pius IX, dividing Great Britain into territorial bishoprics under an archbishop of Westminster. This brief was immediately followed by a pastoral letter by the newly appointed Archbishop, Cardinal Wiseman. This created much popular protest, and at the commencement of the parliamentary session of 1851 was spoken of as a papal aggression, and the necessary measures to counteract it became the chief topics of discussion. It was under these circumstances that Lord John Russell introduced the Ecclesiastical Titles Bill. By a previous act it had been provided that the right and title of archbishops to their respective provinces, of bishops to their sees, and of deans to their deaneries, as well in England as in Ireland, having been settled and established by law, any person, other than the person thereto entitled, who should assume or use the name, style, or title of archbishop of any province, bishop of any bishopric, dean of any deanery, in England or Ireland, should for every such offense forfeit £100. The Roman Catholics claimed that this enactment struck only at the titles of existing provinces and dioceses, and that, while the Pope could not create an archbishop of Canterbury, there was no prohibition against the creation of an archbishop of Westminster. To meet this claim and to remove the doubt that existed, the Ecclesiastical Titles Assumption Act was passed, its object being to prohibit the assumption of such titles "in respect of any places within the United Kingdom." The Catholics always considered the penal clauses of this act to be a grievance, and in time an arrangement was made for its repeal. An act was passed which, after declaring that "no ecclesiastical title of honor or dignity derived from any see, province, diocese, or deanery recognized by law, or from any city, town, place, or territory within this realm, can be validly created," and that no "preëminence or coercive power can be conferred otherwise than under the authority of her Majesty," repealed the Ecclesiastical Titles Assumption Act as inexpedient. The result is that, while no prosecution can now be had for assuming such titles, this assumption is still treated by the law as an illegal act. Practically, however, the law is a dead letter.

#### ECCLESIASTICAL TREATY RIGHTS.

See **TREATY RIGHTS**, **ECCLESIASTICAL**.

**ECCLESIASTICUS**, êk-klē'zī-ās'tī-kūs (Lat., from Gk. ἐκκλησιαστικός, *ekklesiastikos*, relating to an assembly, from ἐκκλησία, *ekklesia*, assembly). The Latin title of a biblical book called, in the Greek version, *The Wisdom of Jesus the Son of Sirach*, and, in the original Hebrew, sometimes *The Wisdom of Ben Sirā*, sometimes *The Proverbs of Ben Sirā*. Books read in public or regarded as suitable for that purpose and therefore kept in places of assembly were designated as *libri ecclesiastici*, or 'church books,' by the Latin Christians. When, largely through the influence of Jerome, books found in the Greek Bible, but not in the generally recognized Hebrew canon, began to be looked upon as only deuterocanonical, or even apocryphal, the term "church books" was not improperly confined to the works still read and cherished by the church, though rejected by the synagogue. Among these, *The Wisdom of Jesus the Son of Sirach*, being used as a textbook

in the instruction of catechumens, naturally became known as the "church book" par excellence; hence the name *Ecclesiasticus*. The Hebrew original was widely read and greatly revered as a holy book in the days preceding the limitation of the canon. (See the heading *Canon of the Bible*, in the article **BIBLE**.) So strongly was it intrenched that, even after the canon had been reduced to 22 or 24 books, it still continued to be used and quoted as Scripture, particularly by the rabbis of Sora. Patristic and mediæval writers, who, on the ground of its absence in the Hebrew Bible, regarded it as canonical only in a secondary degree, freely appealed to its authority in support of doctrine. Its canonicity was rejected by the Reformers, though it was still printed in their versions.

Until 1896 the Hebrew original was known only through quotations in rabbinic literature. Of these there were about 80, amounting to perhaps one-twentieth of the entire text. Since the year mentioned, fragments of four manuscripts have been discovered. All of these have come from the *geniza*, or hiding place for worn-out copies of biblical books and esoteric or forbidden works in the synagogue of Cairo. They cover about four-fifths of the book and furnish in some instances two or three witnesses to the text. Numerous marginal notes also supply variant readings and doublets. Probably no one of the manuscripts is older than the eleventh century. One was evidently made by a Persian Jew, who occasionally put into the margin remarks in his own vernacular. There can be no reasonable doubt that all these manuscripts in the main represent the Hebrew original. But it is equally manifest that the text has been greatly corrupted, and in some cases has been corrected, or at least shaped, under the influence of either the Syriac version itself or an Aramaic targum closely resembling it. The ancient versions therefore remain of utmost importance. Of these, the Greek and the Syriac were made directly from the Hebrew; the Latin, the Syro-Hexaplaric, the Ethiopic, and the Coptic are the chief translations of the Greek. A prologue to the Greek version states that the author's grandson, who translated the work, came to Egypt in the thirty-eighth year of King Euergetes. This can only be Ptolemy Euergetes II, called Physcon, who was the only Euergetes reigning as long as 38 years; the years of his reign are counted from the time when he first assumed power in 170 B.C. Hart has attempted to prove that Physcon was so hostile to the Jews that no Jew would have thought of coming to Egypt in his reign and that the grandson of Ben Sirā came to Egypt in the first year of Euergetes I, which was the thirty-eighth year of Philadelphus, or 247 B.C. But his arguments are far from convincing; such a construction of the phrase "now in the thirty-eighth year under Euergetes" seems indeed impossible. How long after the year 132 B.C. Ben Sirā's grandson lived in Egypt before he was able to undertake the task of translating this book cannot be determined. But it is likely that the work was not completed until the time of Ptolemy Soter II, called Lathyrus, the first period of whose reign extended from 117 to 106 B.C. Another prologue of uncertain authority printed in the editio princeps, the Complutensian Polyglot, may not be older than the fourth century A.D. and draws its information from the work itself. Not even its independent statement that

the translator's name was Jesus can be accepted on so doubtful authority. We are far from possessing the original of this translation. The text presented by the great uncial codices is much inferior to that followed by a group of cursives and one late uncial. Particularly the manuscript printed in the Complutensian has preserved an older and better text. Yet no codex has suffered more by interpolations than this very one. A curious displacement is found in all manuscripts. Without a single exception they pass from xxx. 24 to xxxiii. 16, continue to xxxvi. 11, and then go back to the section xxx. 25-xxxiii. 15. This could not well have found its way into all manuscripts except through the authority and influence of some universally recognized codex. It is difficult to avoid the conclusion that this was Origen's Hexapla. The fact that the Syriac version of Paul of Tella uses the asterisk and obelus to indicate differences from some recognized original, renders it possible that Origen actually compared the Greek text of his book with a Hebrew copy. The displacement may have taken place before his time, and a different arrangement of his small books forming the volume even in this Hebrew copy may have facilitated the error. In some places the Latin and in others the Ethiopic has preserved an earlier and better reading than that found in any manuscript. The Syriac version is a translation from the Hebrew. Its often start " " " " with the recovered Hebrew text " " " " conclusion. But it is evident that here and there it has suffered corruption. Originally made in all probability by a Jew, it subsequently passed through many Christian hands that have left their mark. And occasionally its agreement with the Hebrew seems to be due to the influence it has itself exerted on the latter. Though the facilities for textual criticism have thus been greatly enriched, considerable uncertainty still exists as to the original.

By the discovery of the Hebrew text new questions have been raised as to the name of the author and the integrity of his work. The colophon (l. 27) designates as author Simeon, son of Jesus, son of Eleazar Ben Sira. The statement is repeated in chapter li, and also given in the abbreviated form, "Simeon, son of Jesus, who is called Ben Sira." Ben Sira is consequently the family name that might be added to the proper name of father and son alike. The best Greek manuscripts corroborate the statement that Eleazar was the name of the father of Jesus Ben Sira. If the Hebrew text is to be trusted, the authorship is consequently assigned, not to Jesus, but to his son Simeon. One of the editors also maintains that the name of the translator's grandfather was Simeon Ben Sira. But the name Jesus is too closely associated with the book, both in Jewish and Christian tradition—as the superscriptions, on the one hand, and the application to the author of the legends of the nativity, on the other, show—to permit such an assumption. Another solution suggests itself. Chapters xlii-l once formed a separate book. It has been demonstrated that the old Latin version, which Jerome adopted without much emendation, was made by two different men, living in different lands; chaps. xlii-l not having been translated by the same hand that produced the rest. The unity of this section and its distinct character render it natural that it should have circulated separately.

If that is the case, the colophon in l. 27 refers, not to the entire work, but to these chapters. Internal evidence renders it entirely probable that this part was written in the Hasmonæan period, by the son of Jesus Ben Sira. The reference to a transfer of the high priesthood, and the promise of David to the posterity of Phinehas, because of his zeal, in xlv. 23-26, and the description of the high priest Simon in l. 1-24, seem quite decisive. It is natural that the assumption of the pontificate by the Hasmonæans should have been in need of scriptural support, and the reward promised to Phinehas for his zeal seems to have furnished the necessary prophecy. Scholars have been divided in regard to the identity of the Simon praised in chap. l. Some have thought of a high priest, Simon the Just, supposed to have lived in the beginning of the third century; others of a Simon who held the office a century later. There is no record showing that either of these men achieved any of the deeds for which Simon is lauded. If Simon the Just really lived in the time of Ptolemy Soter, and if this King's harsh treatment actually included the specific damage presupposed, the high priest may indeed have paid attention to the necessary repairs. But Josephus does not seem to have found any mention of this in his sources, since he is able to give no other reason for the title than Simon's piety towards God and kind disposition towards His people. His sources, however, appear to have been late and unreliable. Concerning the Simon who was high priest in the days of Antiochus III, Josephus has no information to give. As evidence of this King's kind feeling towards the Jews, he quotes a letter of his to Ptolemy, in which he tells the Egyptian King, from whom he has just taken Palestine, how generously he is about to reward the inhabitants of Jerusalem for their services in the war. But the letter is manifestly a forgery; and it is significant that Josephus can quote no act, but only a promise, to show the attitude of Antiochus. On the other hand, we know, through 1 Macc. xiii and xiv, that Simon, the Hasmonæan high priest, repaired the temple, fortified the holy hill after the capture of the tower, built walls, and strengthened the city against the enemy. The only feature of the description in Ecclesiasticus l not found in this source is the construction of a cistern; but if Simon filled up the hollow between the Akra and the temple north of it, he is quite likely also to have paid attention to the water supply. There is no reason to doubt the accuracy of the Hebrew colophon. Chapter li is made up of two parts—verses 1-12 and 13-29. The latter is an acrostic poem, each stichos beginning with a new letter of the alphabet. Between both, the Hebrew text has a long hymn, probably written in the second century A.D. The whole chapter is late. In the part of the book that in the main is the work of Jesus Ben Sira, the clear allusion to the death of Antiochus IV in x. 9, the acquaintance with Daniel and the whole tenor of the prayer in xxxvi. 1-17, and the fact that chap. xlii does not seem to have been extant in the Hebrew text used by the Syriac translator—apparently point out these sections as later interpolations. Concerning the time when Jesus Ben Sira lived we have no other evidence than the Greek translator's statement that the author was his grandfather. This would render it probable that he wrote his work between 190 and 170 B.C. In

his theological views he occupies substantially the position of the later Sadducees. When he meets with angels in a biblical passage, he gets rid of them by a rationalistic interpretation. He recognizes no demons. He never hints at any Messianic hope. He is convinced that "the son of man is not immortal." He honors the law, reveres the prophets, but knows as yet no canon of Scripture. He feels that he is himself raised up to be a teacher, even as the holy men of old. His moral philosophy is utilitarian and individualistic. The motive is the happiness that a certain line of conduct will bring. The welfare of others is not presented as a consideration. The author lays down rules rather than principles. He directs how men should act in different situations. His work is not so much a conscious endeavor to find a basis for morality outside of religion, as rather an earnest attempt to commend the righteous life for the happiness it brings to the wisdom-seeking youth of his time.

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**ECCLESIAZUSÆ** (Lat., from Gk. ἐκκλησιάζουσαι, *ekklesiázousai*, women in assembly). An inferior comedy by Aristophanes, produced 392 B.C. His subject is an imaginary national assembly of women, held for the establishment of women's rights, socialism, etc., at Athens. The play is aimed at the attempts to restore the state by means of formal constitutions. See **ARISTOPHANES**.

**ECCLESIOLOGY** (from Gk. ἐκκλησία, *ekklesiá*, church + Gk. λογία, *logía*, account, from λέγειν, *legein*, to say). 1. That branch of the general science of human society or sociology which deals with so much of human relations as exist for the purpose of religion, embracing the analysis of the church as organized society, its constructive principles (see **POLITY**), its relations to the other organizations of society, such as the state, the features of its internal law, and the sphere of its discipline. As con-

structive principles, it considers Episcopacy and Papacy, Presbyterianism, Congregationalism, etc. (qq.v.). 2. The term also connotes that branch of antiquities which deals with the building in which this organized society meets, the church as a structure, and its decoration. It takes note of ecclesiastical architecture, not from the point of view of art history, but from that of its relation to liturgy and ceremonial, iconography, the customs regarding clergy and congregation. It explains the ground plan, elevation, orientation, internal divisions of the church: the form and position of crypt, confessional, altar, lectern and pulpit, choir and choir screen, seats for clergy, books and vessels for sacred service, priestly robes, paschal candlesticks, reliquaries, crosses, croziers, tabernacles for holy oils, holy-water vase, and other church furniture; it also treats of the baptistery, baptismal font, and chrismatory; of the belfry, its bells, chimes, windows; of the chapels, porches, and other subordinate structures. See **CHURCH**; **BASILICA**; **CATHEDRAL**; **TOWER**; **MONASTIC ART**; the separate articles on parts of the church and on articles of church furniture.

**Bibliography.** Rohault de Fleury, *La messe* (Paris, 1883-89), is the fullest systematic study of church furniture; the articles scattered through Smith and Cheetham's *Dictionary of Christian Antiquities* (London, 1877-87) are excellent synopses for the period ending with the early Middle Ages. Durand, a bishop of the thirteenth century, wrote a manual of ecclesiology called *Rationale Divinorum Officiorum* (many editions, and an English translation with an essay by Neale and Webb, "The Symbolism of Churches and Church Ornaments," New York, 1893). Holtzinger, *Altchristliche Architektur* (Stuttgart, 1889), gives the connecting links between liturgy and church architecture and furniture of the early period. Consult also: Andrews, *Curious Church Customs* (Hull, 1895); Bumpus, *A Dictionary of Ecclesiastical Terms* (London, 1910); Lee, *Glossary of Liturgical and Ecclesiastical Terms* (ib., 1877); Ducange, *Glossarium*.

**EC'CLESTON, SAMUEL** (1801-51). An American Roman Catholic clergyman. He was born in Kent Co., Md., and studied at St. Mary's College, Baltimore, of which he became president in 1829. In 1834 he succeeded Dr. Whitfield as Archbishop. Under his auspices the Christian Brothers established a novitiate and training school of their order, parochial schools were multiplied, and several academies for girls were established under the Nuns of the Visitation.

**EC'DY'SIS.** See **MOLTING**.

**ECGBERTH.** See **EGBERT**.

**EC'GONINE.** See **ALKALOIDS**.

**E CHANG.** See **I CHANG**.

**ECHEGARAY, á'chá-gá-rí', José** (1835- ). A Spanish playwright, scientist, and politician, born in Madrid. He received a professorship of mathematics at the school of engineering. He was Minister of Public Instruction in 1873 and Minister of Finance in 1874 and 1905. In 1874 his plays *El libro talonario* and *La esposa del vengador* marked the beginning of a splendid dramatic career for himself and the opening of a new epoch in the history of the Spanish stage. He wrote, all told, some 70 plays in verse and prose. His tone is one of almost uniform gloom, relieved, however, by the presence of a sane belief in the



efficacy of moral law and by a splendid idealism. His principal plays are: *En el puño de la espada* (1875); *Ó locura ó santidad* (1876); *En el seno de la muerte* (1879); *El gran Galeoto* (1881), treating of the power of slander and considered his best work; *Vida alegre y muerte triste* (1885); *Mariana* (1892); *El hijo de Don Juan* (1892), based on, and identical in theme with, Ibsen's *Ghosts*; *El estigma* (1895); *La duda* (1898); *El loco Dios* (1900); *La escalinata de un trono* (1903); *La desequilibrada* (1903); *A fuerza de arrastrarse* (1905). In 1904 he shared with Mistral the Nobel prize for literature. Americans are familiar with *El gran Galeoto* not only through Charles Frederick Nirdlinger's translation, but through the stage production by Mr. and Mrs. William Faversham, under the title "The World and his Wife." Three other works have also appeared in English translation: *El loco Dios*, as *The Madman Divine*, by E. H. West (in *Poet Lore*, vol. xix, 1908); *Ó locura ó santidad*, as *Madman or Saint*, by Ruth Lansing (in *Poet Lore*, vol. xxiv, 1912); and *Mariana* (New York, 1914). Consult: A. Zacher, *Don José Echegaray, Der Verfasser des Galeoto* (Berlin, 1892); F. Vézinet, *Les maîtres du roman espagnol* (Paris, 1907); L. Antón del Olmet and A. García Caraffa, *Echegaray* (Madrid, 1912); H. de Curzon, *Le théâtre de José Echegaray* (Paris, 1912).

**ECHELON**, esh'e-lôn (Fr., round of a ladder, from *échelle*, OF. *eschelle*, ladder, from Lat. *scala*, ladder). A military formation. A regiment, when ordered to advance in echelon, would proceed as follows: The leading or named company would advance, followed at company distance by the remaining companies, each marching in a direction perpendicular to its front, so that, if the leading company were to halt, the remainder would return to the original line formation. The echelon formation is valuable because of the facility with which "line" may be formed in any direction—front, flank, or rear; it also presents certain obstacles to accurately sighted rifle fire from the enemy. The word "echelon" is also sometimes used, in a broader sense, to designate the subdivisions in rear of the advance element of a large organization or system of supply; e.g., the ammunition supply of the firing battery is usually obtained from the echelons in rear in the following order: combat train, ammunition column, line of communication trains, advance-supply depot.

**ECHENEIS**, êk'e-nê'is, **ECHENEIDIDÆ**, êk'e-nê-id'î-dæ. See REMORA.

**ECHENIQUE**, a'chá-nê'ká, JOSÉ RUFINO (1808-87). A Peruvian soldier and statesman, born at Puno. When the army under Gamarra and Bermudez revolted, in 1833, he restored order, and later fought in the cause of Santa Cruz and the confederation, but made his peace with Gamarra. In 1846 he became a member of Castilla's council. He was elected President of Peru, April 20, 1851. His administration was remarkable in many ways. He undertook more public works than any of his predecessors and did more than they for the spread of public instruction. And despite all that, he was able, in 1853, to show a balance of 3,000,000 pesos in the budget. He instituted important reforms in the management of the public debt, restoring the nation's credit both at home and abroad. He negotiated important

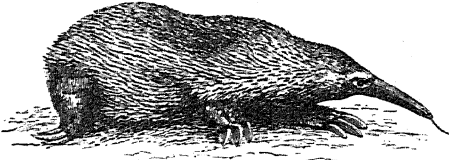
treaties with several European nations. Despite the parlous times in which he lived and the practices of many other statesmen of his day, he never had recourse to the death penalty. He remained in office until 1855, when repeated revolts against his authority, culminating in his defeat by Castilla, resulted in his banishment from the country. Returning in 1862, he was at once elected deputy, and in 1864 President of the Chamber. Later he was elected senator and became President of the Senate. He aided in the defense of Callao during the Spanish War of 1866. His candidacy for the presidency in 1872 was not successful.

**ECHEVERRÍA**, ā'chā-vēr-rē'ā, ESTÉBAN (1809-51). A South American poet, born at Buenos Aires. His education was French, and his early works showed that influence, but he afterward became more national, and his poem *La cautiva* (1837) contains fine descriptions of the pampas. He was exiled by the Dictator Rosas and went to Montevideo, where he died. His complete works were published at Buenos Aires in 1874, in 5 vols., under the direction of Juan Maria Gutiérrez, an Argentine man of letters.

**ÉCHEVIN**, āsh'vān' (OF., Fr. *eschevin*, It. *schiafino*, *scabino*, from ML. *scabinus*, sheriff, from OHG. *skeffino*, Ger. *Schöffe*, from OHG. *scaffan*, Ger. *schaffen*, to create). During the early Middle Ages, a royal officer possessing a large measure of power in local administration. The office was common in France and the Low Countries and prevailed to a less degree throughout Germany. It first appears in the documents of the eighth century. When Charles the Great reformed the administration, the *échevins* became royal officers for the counties and hundreds. They were named by the *missi*, or royal deputies, the counts, and the people, and held their office during good behavior. The system continued without any important change during the Carolingian period. In the tenth century the *échevins* were given jurisdiction over the nonnoble class, the peasants, and the towns, and later became municipal magistrates. At the close of the twelfth century the *échevins* in the towns were elected yearly. The *échevins* seem to have formed a body or tribunal which in many cases not only administered justice, but controlled military affairs and imposed police regulations. In the north of France these tribunals were especially numerous. The powers of the *échevins* declined after the sixteenth century, and the central government, in 1764, sought to unify the whole system of *échevinage* by limiting the number to four for all large towns. In Paris there were four *échevins*, two chosen each year. Their powers were limited to the regulation of trade, fixing the prices of commodities, and settling the disputes of tradesmen. The office of *échevin* was abolished in December, 1789, during the first period of the French Revolution. The title is now used in Belgium for an assistant to the burgomaster. Consult Cheruel, *Dictionnaire historique des institutions, mœurs, et coutumes de la France*, vol. i. (Paris, 1874).

**ECHIDNA**, ê-kid'nā (Lat., Gk. *ἐχίδνα*, viper, from *ἐχis*, *echis*, Skt. *ahī*, Av. *azhi*, serpent). A genus and family (Echidnidae) of monotreme mammals, the spiny or porcupine anteaters of the Australian region, closely allied to the duck-bill. The ordinary echidna is from 12 to 18

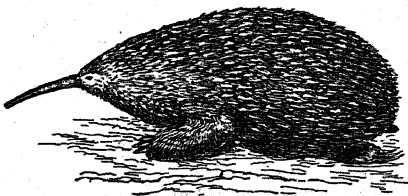
inches long and has a broad, depressed body, mounted upon very short, strong legs terminating in big, powerful claws suited to digging into hard ground. The head is small, and the nose prolonged into a slender snout; the mouth



AUSTRALIAN SPINY ANTEATER.  
(*Echidna aculeata*.)

is without teeth, but the palate is studded with recurved spines, and the tongue is slender, extensible, and glutinous. The back of the animal is covered with stiff, hedgehog-like spines, mixed with long, coarse hairs; and when danger threatens it outside its burrow, it curls up much like a hedgehog, so as to protect the under parts, which have no spines, but are clothed in silky brown hair. The males have spurs on their heels, like the duckbill (q.v.), but have never been seen to use them. It dwells in burrows of its own digging and obtains its food by excavating in the hillocks of ants, which it tears open in order to devour the succulent larvæ. Like other monotremes, the echidnas lay eggs. After a period of gestation of 27 or 28 days one or two eggs are laid, and one is placed in the temporary pouch, where after about two weeks it hatches. The young echidna is carried in the pouch until fairly good-sized and able to walk. They are gentle in disposition, endure confinement well, eating bread and milk, chopped eggs, etc., and are frequently kept as intelligent and playful pets, exhibiting a good deal of activity and agility. They are inclined to nocturnal habits and in times of drought become dormant in their burrows.

The common echidna (*Echidna aculeata*) seems to be very variable in size, color, and length of spines, and some naturalists have separated the large Tasmanian form as *Echidna setosa*, and the small New Guinea form as *Echidna laevis*, but their specific value is doubtful. In New Guinea there also occurs a closely related animal, *Proechidna* (or *Acanthoglossus*)



THREE-TOED PAPUAN ANTEATER.  
(*Proechidna bruijnii*.)

*bruijnii*, which is much larger, has only three claws on each foot, and its snout and tongue are greatly prolonged. The Papuans call them nodiahs, and hunt them for food in the Arifak Mountains by the aid of dogs which know how to dislodge them from their burrows. Consult: Bennett, *Gatherings of a Naturalist in Australia* (London, 1860); Saville-Kent, *The Naturalist in Australia* (ib., 1897); Lucas and Souëf,

*Animals of Australia* (Melbourne, 1909); English, *The Sphere*, vol. liv (London, 1913). See MONOTREME.

**ECHINADES**, ê-kîn'â-dêz (Lat., Gk. Ἐχινάδες, from ἔχινος, *echinos*, hedgehog). A group of islands in the Ionian Sea, now known as the Kurzolari Islands. They are situated around the entrance of the Gulf of Corinth and are supposed to have been formed by drift from the river Achelous. Off these islands was fought the celebrated battle of Lepanto in which Admiral Doria and Don John of Austria overwhelmed the Turkish fleet under Ali Pasha (Oct. 7, 1571).

**ECHINIDÆ**, ê-kîn'î-dê. See SEA URCHIN.

**ECHINOCARIS**, ê-kî'nô-kâ'ris (Neo-Lat., from Gk. ἔχινος, *echinos*, hedgehog + *kâris*, *shrimp*). A fossil crustacean, the tail spines of which are common in certain Devonian rocks. See PHYLLOPODA.

**ECHINOCOCCUS**, ê-kî'nô-kôk'kûs. See TAPEWORM.

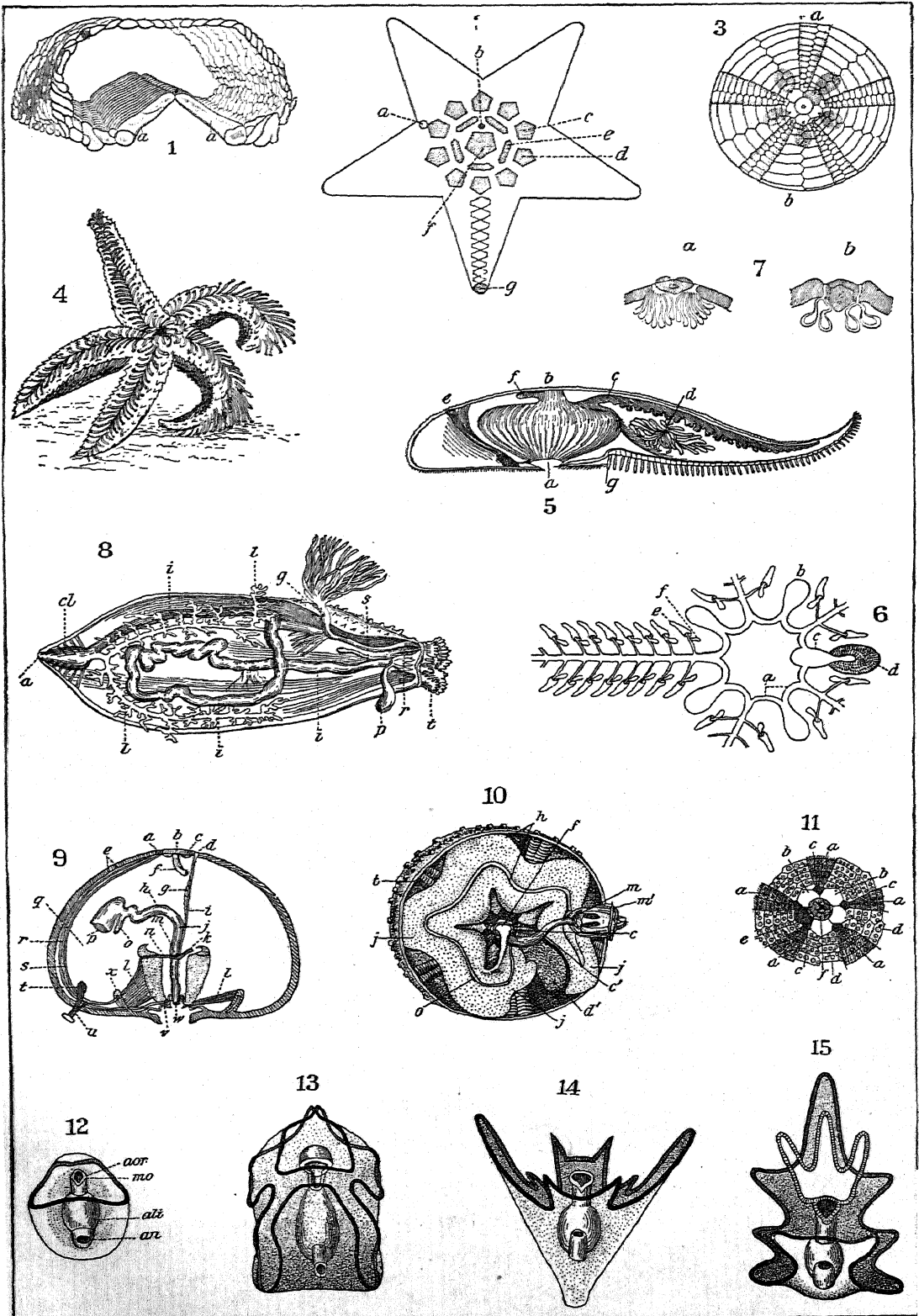
**ECHINOCONUS**, ê-kî'nô-kô'nûs (Neo-Lat., from Gk. ἔχινος, *echinos*, hedgehog + *kônos*, *a cone*). A genus of large, conical, or subhemispherical echinoids with flat actinal region and sunken peristome, found abundantly in the Lower and Middle Cretaceous rocks. See ECHINODERMATA; ECHINOIDEA.

**ECHINODERMATA**, ê-kî'nô-dêr'mâ-tâ (Neo-Lat. nom. pl., from Gk. ἔχινος, *echinos*, hedgehog + *derma*, *skin*). One of the great branches or phyla of invertebrate animals, constituting an independent, well-characterized assemblage of organisms. The group is of higher rank than the Cœlenterata and is lower than the Vermes, with both of which groups it has few features in common. The animals of this phylum do not reproduce by either budding or

#### EXPLANATION OF THE PLATE OF ECHINODERMATA.

1. Section of the ray of starfish, showing structure of the skeleton: *a*, *a*, ambulacral ossicles, between which lies the ambulacral vessel in the ambulacral groove. 2. Aboral plates of a starfish: *a*, madreporite; *b*, anus; *c*, one of the five basal plates; *d*, one of the five radials; *e*, circle of secondary radials; *f*, dorsocentral; *g*, terminal or ocular plate (cf. Plate of Crinoids, Fig. 7). 3. Aboral view of a sea urchin, stripped of epidermis: *a*, ambulacral plates, in five zones; *b*, plates of interambulacral zone. 4. Tube feet of a starfish, as used in turning the body over. 5. Section of the disk and arm of a starfish: *a*, mouth, leading into the wide stomach; *b*, anus; *c*, hepatic prolongation of the stomach into the cavity of the arm; *d*, genital organs; *e*, madreporic plate (opening of madreporic or stone canal); *f*, intraradial diverticulum of the rectum; *g*, ambulacral feet. 6. Diagram of the water-vascular system of a starfish: *a*, oval circular vessel; *b*, one of the ampullæ or Polian vesicles; *c*, stone canal; *d*, madreporic plate; *e*, one of the series of ambulacral feet connected with the side twigs of the radial canal; *f*, one of the ampullæ of the same. 7. Transverse sections of the ambulacral fields of two blastoids, showing forms of hydrospires: *a*, Orophocrinus; *b*, Granatocrinus. 8. Anatomy of a holothurian: *i*, tentacles; *r*, calcareous ring at the base of the tentacles; *p*, Polian vesicle; *s*, sand canal; *t*, *t*, alimentary canal; *g*, duct of the reproductive organs; *cl*, cloaca; *a*, anus; *l*, *l*, respiratory tree. 9. Vertical section of an echinoid (sea urchin): *a*, ocular plate; *b*, anus; *c*, aboral ring blood vessel; *d*, madreporite; *e*, radial extension of the stomach, surrounding the radial nerve; *f*, rectum; *g*, ovoid gland; *h*, intestinal blood vessel; *i*, stone canal; *j*, alimentary canal; *k*, Polian vesicle; *l*, *l*, muscles passing from the auricles to Aristotle's lantern; *m*, oral ring blood vessel; *n*, radial ambulacral vessel; *o*, siphon; *p*, intestine; *q*, cœlome; *r*, radial nerve; *s*, radial ambulacral vessel; *t*, ampullæ; *u*, ambulacral feet; *v*, radial nerve; *w*, mouth; *x*, auricle. 10. Horizontal section of a sea urchin, showing organs (letters as in Fig. 9); also, *c*, cœsophagus; *d'*, ovary; *m'*, Aristotle's lantern. 11. Apical system of plates and aboral extremities of zones of the shell of a sea urchin: *a*, ambulacral zones; *b*, genital plates; *c*, (black) ocular plates; *d*, interambulacral zones; *e*, madreporite; *f*, periproct. 12-15. Diagrams of the development of the larvæ of echinoderms: 12, primitive form; 13, auricularia (holothurians); 14, a pluteus (sea urchins and brittle stars); 15, a bipinnaria (starfishes).

# ECHINODERMATA





fission, and therefore they are never found in compact colonies like those formed by the cœlenterates. The body of the animal is built, more or less constantly throughout the phylum, on the pentamerous plan of bilateral symmetry, in accordance with which the number five is a dominant feature in the arrangement of the parts.

**External Covering.** The external covering of the echinoderms is remarkable for its diversity, for even within the limits of the same family we find a soft, leathery body wall at one extreme and a firm, almost immovable "shell" at the other. This diversity is entirely due to the amount of mineral matter deposited in the body wall and the plates formed from it. In the body wall is chiefly composed of connective tissue, within which are deposited disconnected particles of lime, while in most sea urchins there is little connective tissue and the carbonate of lime is deposited in firm plates of definite size and shape firmly welded into a hard shell, or "test," as it is commonly called. This external covering usually functions quite as much as a skeleton for the attachment of muscles as it does as a "shell" for protection. The body wall is often covered with more or less evident knobs, tubercles, or spines, and from the frequency of the latter has arisen the name "spiny-skinned" animals. These knobs and spines are attached to the plates of the skeleton, either immovably or by a joint which permits of perfect freedom of movement.

**Visceral Anatomy.** There is a well-developed alimentary canal suspended in and distinct from the general body cavity, or cœlome, and provided with both mouth and anus, though the latter may be more or less suppressed in some groups. A combined respiratory and locomotory system of complicated nature, called the water-vascular system, is peculiar to the members of this phylum only. A nervous system, blood-vascular system, and reproductive system are more or less fully developed.

The nervous system is variously modified in the different classes of echinoderms. In all there is a well-developed epidermal system, with circumoral ring and radial branches.

Sense organs are few and imperfect. We find occasionally pigment eyes, ciliated pits (perhaps olfactory), and positional organs. The sense of touch is well developed. The blood system is rarely developed, though many forms have an "axial organ and strands," the anatomy and physiology of which are still little understood. Special respiratory and excretory organs are found in a few cases.

The water-vascular system, which is present in more or less complete form in all members of the group, consists of a ring vessel about the mouth. From this ring vessel a number of tubes, generally five, radiate to the ambulacral areas, or "radii." These tubes connect with the "tube feet," or ambulacra, which are extensible sac-like tentacles that project from the surface of the body through pores in the plates of the ambulacral areas. These tube feet function not alone as locomotory organs, but also as respiratory organs, and in some classes they assist in conveying food to the mouth. The circumoral ring vessel has communication with the outside, in most echinoderms, through a tube of variable form, called the stone canal or madreporic canal, which extends from the ring vessel to a special plate, the madreporic plate, on the

aboral side of the body. This plate is sieve-like, and through it is sucked the water that fills the water-vascular system. Connected with the ring vessel, in all classes except the Crinoidea, are peculiar bladder-like organs, the Polian vesicles, that serve to regulate the pressure in the radial tubes. Lack of active locomotion obviates the necessity for a well-developed muscular system, although some special muscles of complicated nature are present in connection with particular organs, as the jaws of echinoids.

The mouth of echinoderms is sometimes, especially in the Holothuroidea, surrounded by a crown of tentacles. Usually it is a simple opening, but in the Echinoidea (sea urchins) it is provided with a complex system of jaws that form the so-called "Aristotle's lantern." Outgrowths from the alimentary canal, called "respiratory trees," found in the holothurians, and an accessory intestine, attached to the intestine proper in the echinoids, and other modifications of various organs, constitute the respiratory organs; there are no strictly special respiratory organs in the members of this branch.

The sexes are separate, and development takes place through metamorphosis. The egg produces a bilaterally symmetrical free-swimming larva, which differs somewhat in form in the different classes. Three types of larva have been distinguished, and they have received the names auricularia, bipinnaria, and pluteus.

**Ecology.** About 3000 living echinoderms are known. They are all marine, and the species are scattered through all seas of the globe and are found at all depths, but they are most abundant in the warm seas of the tropics. The only fixed members of the branch are those included in the subbranch Pelmatozoa, comprising the crinoids, cystoids, and blastoids. Many echinoderms, especially the crinoids, are gregarious, and they are found associated together in vast numbers. Echinoderms are largely benthonic organisms, crawling slowly on the bottom of the sea by means of the tube feet or arms, as in the starfish and sea urchins, or by the oral tentacles, as in holothurians. The fixed pelmatozoans are either benthonic, when fixed to the bottom, or pseudoplanktonic, when attached to floating wood, and the free-swimming crinoids almost fall among the pelagic animals or plankton.

**Classification.** The Echinodermata are divided among the following seven classes: Holothuroidea, Echinoidea, Asteroidea, Ophiuroidea, Crinoidea, Cystoidea, and Blastoidea. The last three groups, comprising mostly attached forms, are often included as subclasses under a class Pelmatozoa. We prefer to associate the first four in a subbranch Eleutherozoa, and the last three in a second subbranch, Pelmatozoa. The characters of the various classes are as follows:

**I. HOLOTHUROIDEA** (holothurians, or sea cucumbers). The body is cylindrical or wormlike, and has a soft leathery skin, in which are imbedded minute calcareous spicules or plates. A certain degree of bilateral symmetry is apparent, but there is little trace of radial pentamerous symmetry. The mouth is at the anterior end of the body and is surrounded by tentacles; the anus is at the posterior end. The only portions of holothurians that are apt to be preserved as fossils are the calcareous bodies of the skin. These are known in rocks of Carboniferous to

recent time, but they are never common. See HOLOTHURIAN.

II. ECHINOIDEA (sea urchins). In this group the body is inclosed in a more or less rigid box of polygonal stony plates, arranged in rows that form five ambulacral and five interambulacral areas. In the more regular, radial forms both the mouth and the anus are central on opposite surfaces of the body. In other irregular forms, exhibiting less radial and greater bilateral symmetry, the mouth may be placed towards the anterior end and the anus is variously situated, either on the dorsal, lateral, or ventral surface, but always in the middle line. The majority of echinoids have complicated jaws. About 300 living and 2500 fossil species are known. The earliest appear in Ordovician rocks. See ECHINOIDEA; SEA URCHIN.

III. ASTEROIDEA (starfish). The bodies of the animals of this class are flattened dorsoventrally, and the ambulacra are produced into five (or some multiple of five) radiating arms. The arms are not at all demarcated from the central portion of the body, and they contain prolongations of the coelome and of most of the organs. Radial symmetry is quite marked. The tough skin contains calcareous plates of irregular form that are not united to each other, so that the body wall is to some extent flexible. The ambulacral plates occupy the larger portion of the undersides of the arms, and the tube feet are well developed. The large mouth opening is in the centre of the ventral surface of the disk, and the small anal opening is near the centre of the dorsal surface, except in a few genera, where it is wanting, and the intestine is then closed. The earliest starfish appear in rocks of Ordovician age, and they have continued, though never becoming abundant, through all subsequent periods down to the present time. See STARFISH.

IV. OPHIUROIDEA (brittle stars). The animals of this group have the body flattened in the same manner as in the Asteroidea, with the ambulacral arms produced into five long rays that are either simple or many times branched. The body is covered by stony plates that present a greater degree of systematic arrangement than is seen in the Asteroidea, and they are more firmly united. The central disk is well demarcated from the arms, and no portions of the coelomic cavity or diverticula of the alimentary canal or genital system enter them. The arms serve for locomotion. The mouth is central on the ventral surface, and the anus is closed. The class makes its first appearance in Silurian rocks, and it is represented, though rarely, in rocks of all later periods. At present its members are widely distributed. See OPHIUROIDEA; BASKET FISH; BRITTLE STAR.

The subbranch Pelmatozoa, including the Crinoidea, Cystoidea, and Blastoidea, constitutes a group of mostly attached echinoderms in which the body is inclosed in a somewhat cup-shaped, spherical, or saclike box of calcareous plates, and is raised, during at least a portion of the life of the individual, upon a stalk with the ventral surface and mouth upward.

V. CRINOIDEA (sea lilies). These are pelmatozoans in which the cup-shaped body wall is made up of closely joined plates arranged according to definite plans of pentamerous radial symmetry, the arrangement varying in every family according to the number of plates in the "calyx," or body cup. The calyx bears five simple or branched, highly flexible arms, that are pro-

vided with pinnules to screen food from the water. The mouth is at the middle of the upper or ventral surface, and the anus is excentric. Both these orifices undergo peculiar and important modifications that are used in classifying the members of the group. The class appeared in Ordovician time and was exceedingly abundant during the Paleozoic era. About 2000 fossil species, in 175 genera, and 600 living species are known. See CRINOIDEA.

VI. CYSTOIDEA. Pelmatozoans with spherical or saclike body inclosed in a more or less irregular box, composed of more or less closely united polygonal plates that present definite plans of arrangement only in the most advanced forms. The animals were sessile, stalked, or free. The arms are poorly developed and in some forms are not separated from the oral surface of the body, in which case they appear as ambulacral grooves radiating from the mouth. The mouth is central, and the anus is always excentric and is placed either on the oral or aboral surface. In some forms the mouth is slightly excentric. The earlier and more primitive members of the class are spherical, with the plates very irregular. There are some genera which exhibit tendencies towards the crinoid type; others resemble the blastoids or the echinoids, or starfish. On this account the cystoids have by some authors been considered to resemble, more nearly than any other class, if not actually to represent, the original primitive echinoderm stock from which were derived through evolution all the other classes. Cystoids appear in the rocks of Upper Cambrian age, being the earliest group of echinoderms, and they reached a considerable expansion in the Ordovician and Silurian periods. They disappeared at the close of the Paleozoic. See CYSTOIDEA.

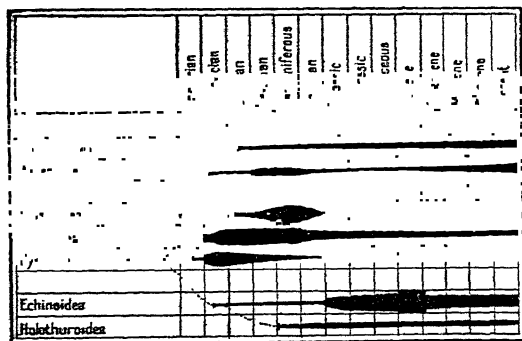
VII. BLASTOIDEA (Pentremites). This is a small, extinct, specialized group of echinoderms, derived from the cystoids at perhaps an early Ordovician date, that did not reach its maximum development until Carboniferous time. Then, however, after the cystoids had quite disappeared, and the crinoids had begun to decline, this group attained considerable prominence, so that its members are characteristic index fossils of the Carboniferous and Permian rocks. The class became extinct at the close of the Paleozoic. The body is inclosed in a bud-formed box made up generally of 13 plates of regular form and strictly pentamerous radial arrangement. The mouth is at the summit of the calyx, and the anus at the side. There are no arms, and the relatively large ambulacral areas extend downward over the surface of the calyx, sometimes nearly to the base or stem. The stem was short or absent. About 20 genera and 150 species are known. See PENTREMITES.

**Bibliography.** For general treatises on both living and fossil forms, see Bather, "The Echinoderma," in Lankester's *Treatise on Zoology*, part ii (London, 1900); this contains a good bibliography. Consult also: Parker and Haswell, *Textbook of Zoology*, vol. i (London and New York, 1910); Lang and Bernard, *Text-Book of Comparative Anatomy*, part ii (ib., 1896), also with a bibliography. These last two works are technical. Zittel and Faxon, *Text-Book of Paleontology*, vol. i (ib., 2d ed., 1913), deals almost entirely with the fossil forms. Consult also: Alexander Agassiz, "Paleontological and Embryological Development," *Proceedings of the*



American Association for the Advancement of Science, Boston Meeting (Cambridge, 1880); Carpenter, "Notes on Echinoderm Morphology," *Quarterly Journal of the Microscopical Society*, N. S., vols. xviii-xxviii (London, 1878-87); Bell, "On the Arrangements and Interrelations of the Classes of the Echinodermata," *Annals and Magazine of Natural History*, series vi, vol. vii (ib., 1891); Ludwig, *Morphologische Studien an Echinodermen* (Leipzig, 1877-82); Neumayr, *Die Stamme des Thierreiches* (Vienna and Prague, 1889); W. B. Clark, "The Mesozoic Echinodermata of the United States," *Bulletin United States Geological Survey*, No. 97 (Washington, 1893). See also the works cited under the articles on various classes of echinoderms above referred to.

For description of the ontogeny or development of the echinoderms, consult the works by Lang and Bather mentioned in the bibliography. The following diagram is intended to represent both the geological distribution and the phylogenetic relationships of the various classes:



**ECHINOIDEA**, êk'i-noi'dé-à (Neo-Lat. nom. pl., from Gk. *êxivos*, *echinos*, hedgehog + *eidos*, form). One of the five classes of Echinodermata (q.v.), containing the sea urchins and their kindred. It is subdivided into four orders: (1) Palæo-Echinoidea, all fossil; (2) Regularia, the typical globular echinoids, or sea urchins; (3) Clypeastridea, the flattened cake urchins and sand dollars; (4) Spatangoides, the cordate heart urchins. For further details of existing forms, see SEA URCHIN. Consult Jackson, "Phylogeny of the Echini, with a Revision of the Palæozoic Species," in *Memoirs of the Boston Society of Natural History*, vol. vi (1912).

**ECHINOSPHERITES**, êk'i-nô-sfê-rî'têz (Neo-Lat., from Gk. *êxivos*, *echinos*, hedgehog + *σφαῖρα*, *sphaira*, ball). A genus of cystids with globose, nonpedunculate calyx, composed of numerous irregularly arranged plates, all of which are furnished with pore rhombs. Certain species, especially *Echinospherites aurantium*, occur in great abundance in the Ordovician of Russia and Scandinavia and also in that of North America. See CYSTOIDEA.

**ECHTUM**, êk't-um. See VIPER'S BUGLOSS.

**ECHIURIDA**, êk'i-û-rî-dâ. An order of annelids. See ANNULATA.

**ECHMIADZIN**, êch'mê-âd-zên'. See ECHMIADZIN.

**ECHO** (Lat., from Gk. *ἠχώ*, *Echō*; cf. *ἠχῆ*, *êchê*, sound, noise, echo). A personification in Greek mythology. According to the legend, the mountain nymph Echo, by her talking, detained Hera when she sought to surprise Zeus among

the mountain nymphs. As a punishment, the goddess deprived her of the power of speech unless first spoken to, when she was compelled to reply. The love of Pan for Echo was also celebrated by later poets. According to Ovid (*Met.* iii, 356-401) the nymph Echo, having conceived a hopeless passion for Narcissus, pined away until only her voice remained. A portico at Olympia, where there was a sevenfold echo, was called by the nymph's name. These stories of Echo date from the time of Euripides.

**ECHO**. Sound is produced by waves or vibrations of the air or through which it travels, and these waves on striking a surface are reflected . . . the laws of reflection. A sound . . . is termed an echo, and the rule that the angle of incidence must equal the angle of reflection holds good, as in the case of light and other forms of wave motion. If the sound is reflected by an obstacle at right angles to the direction of propagation, the echo returns to an observer at the place where the sound originated. This phenomenon enables one to ascertain the distance to a cliff or other surface from which an echo is obtained, and is made use of by navigators when approaching in a fog a shore with cliffs. Knowing that sound at ordinary temperatures travels with an approximate velocity of 1125 feet per second, by multiplying this figure by the time between the sound—that of a steam whistle, e.g.—and the perception of the echo, we obtain the distance to the cliff and back. Reflection also takes place from the surface of a cloud, as is the case with thunder, and an uneven surface such as that presented from the edge of a wood, which often will furnish excellent echoes. Echoes in auditoriums often present unpleasant effects which are difficult to overcome, as they produce an interference of the sound waves that destroys the effect to the auditor. Proper consideration of the size and shape and of the nature of the reflecting surfaces must be given in designing an auditorium. Consult Sabine, *Architectural Acoustics* (Boston, 1900).

**ECHO, IN MUSIC**. 1. A subdued repetition of a phrase. 2. In large organs there is a separate set of pipes, placed at a distance so as to produce the effect of an echo. There are separate stops and generally also a special manual.

**ECHO CAÑON**. A long and deep gorge formed by the Weber River, in northern Utah, on the Union Pacific Railroad (Map: Utah, C 2). It is about 20 miles northeast of Salt Lake City, and is famous for its echoes and sublime scenery. The sides of the cañon are of bare rock and almost vertical. Owing to erosion, many of the rocks have assumed curious shapes.

**ECHTER**, êk'têr, MICHAEL (1812-79). A German mural painter. He was born in Munich, received his artistic training at the academy there, and assisted Julius Schnorr von Karolsfeld (q.v.) in the decoration of the *salle des fêtes* of the royal palace at Munich with 19 wall paintings derived from the history of Rudolph of Hapsburg, Charlemagne, and Frederick Barbarossa. With W. Kaulbach (q.v.) he restored certain mural works in the Berlin Museum, and subsequently he established himself in Munich, where he executed several important commissions, including decorative paintings in the Bavarian National Museum, and "The Battle on the Lechfeld," a large canvas to form one in a series of thirty historical pictures in the Maximilian-

neum. He also painted scenes from Wagnerian opera for King Louis II of Bavaria. In 1868 he was appointed a professor in the Munich School of Industrial Arts.

**ECHTERMEYER**, ĕk'tĕr-mĕ'ĕr, ERNST THEODOR (1805-44). A German critic and compiler, born at Liebenwerda. His *Auswahl deutscher Gedichte* (1837; 34th ed., 1903) has been widely circulated in Germany.

**ECHTERNACH**, ĕk'tĕr-nāĕ. A town in the Grand Duchy of Luxemburg, situated amid beautiful scenery on the Sure, 18 miles northeast of Luxemburg. It is celebrated for its Benedictine abbey, founded in 698, which retained its autonomy until 1801. The Romanesque abbey church of St. Willibrord, dating from 1017, now restored, is noted for its archaeological features. The Dingstuhl, or Rathaus, and the Casino Garden are also noteworthy. Boat building is one of the chief industries; the manufacture of damask, woolen goods, leather, and faience is also carried on. The "Dancing Procession," peculiar to Echternach, in which from 12,000 to 15,000 persons from the surrounding region take part annually each Whit-Tuesday, dates from the eighth century, when the intercession of St. Willibrord was invoked against the cholera which was afflicting Germany and Holland. It has now come to be an annual occasion of pilgrimage, especially for those suffering with St. Vitus's dance. Pop., 1900, 3538; 1910, 4300. See Sax, *Beiträge zur geschichte der abtei Echternach* (Luxemburg, 1874).

**ECHTER VON MESPELBRONN**, fŏn mĕs'pĕl-brŏn. See JULIUS ECHTER VON MESPELBRONN.

**ECHUCA** (formerly HOPWOOD'S FERRY). A town and river port of Victoria, Australia, on a peninsula formed by the Murray and Campaspe rivers, 157 miles north of Melbourne (Map: Victoria, D 4). A roadway and railway bridge, 1905 feet long, of the Murray River Railway, connects Echuca with Moama, on the New South Wales side of the Murray River. It has important vineyards and wine factories and a considerable river trade in wool, wine, and red-gum timber. Pop., 1901, 4078; 1911, 3546.

**ECIJA**, a'thĕ-nā. A city in the Province of Seville, Spain, 47 miles east by north of the city of Seville, on the river Genil, at the head of navigation, and on the Córdoba-Cádiz Railway (Map: Spain, C 4). It is well built, the streets and plazas being clean and paved, and has handsome gardens. A fine promenade extends along the river, and in the Plaza Mayor stands the municipal building, one of the notable structures of the city. The Plaza de Toros, well known as the scene of some of the most exciting bullfights in Spain, occupies the site of the Roman amphitheatre. Ecija contains hospitals, asylums for orphans and the aged, barracks, and a large theatre. A long and narrow stone bridge spans the Genil at this point. The climate is excessively hot. The city is the centre of a productive agricultural section, and has important manufactures. Its footwear is known throughout Spain, and there are several woolen, linen, and silk mills, flour mills, and tanneries. Pop., 1900, 23,472; 1910, 23,217. Ecija is an ancient city, some ascribing its origin to the Greeks long before the rise of the Romans. Anciently known as *Astigi*, it was named *Colonia Julia Augusta Firma* by the Romans, under whom it ranked in importance with Córdoba and Seville. It occupied a prominent place as a border town in the struggle between the Moors

and Christians. There are still extant Roman remains, and several gates and towers representative of Moorish architecture.

**ECK**, ERNST WILHELM EBERHARD (1838-1901). A German jurist. He was born in Berlin and was educated at the university of that city and at Heidelberg. He held professorships at Berlin (1871), Giessen (1872), Halle (1873-77), Breslau (1877-81), and Berlin (after 1881). His principal works include: *Die sogenannten doppelseitigen Klagen des römischen und gemeinen deutschen Rechts* (1870); *Die Verpflichtung des Verkäufers zur Gewährung des Eigentums nach römischem und gemeinem deutschen Recht* (1874); "Die Stellung des Erben," etc., in Bekker and Fischer, *Beiträge zur Beurteilung des Entwurfs eines bürgerlichen Gesetzbuchs* (1890).

**ECK**, HEINRICH (1837- ). A German geologist. He was born at Gleiwitz, Silesia, and was educated at Breslau. After participating in the Prussian geological survey in Thuringia and Silesia, in 1862, he was appointed lecturer at the mining school in Berlin in 1866, and professor of mineralogy and geology at the Polytechnic Institute, Stuttgart, in 1871. His investigations are devoted principally to the Triassic deposits, and are discussed in numerous writings which appeared in the publications of the German Geological Society. His larger works include: *Ueber die Formationen des bunten Sandsteins und des Muschelkalks in Oberschlesien und ihre Versteinerungen* (1865); "Rüdersdorf und Umgegend," in *Abhandlungen zur geologischen Spezialkarte von Preussen*, vol. i (1872). He wrote also: *Das Erdbeben in der Gegend zwischen Strassburg, Forbach.....am 11. Juni 1887* (1892); *Verzeichnis der mineralogischen, geognostischen, vorgeschichtlichen und balneographischen Litteratur von Baden, Württemberg, Hohenzollern...* (1880, with additions in 1901).

**ECK**, JOHANN MAIER VON (1486-1543). A German theologian, the well-known adversary of Luther and opponent of the Reformation. He was born at Eck (now Egg), Suabia, Nov. 13, 1486). He studied at Heidelberg (1498), Tübingen (1499), and Freiburg (1501). He became doctor of theology at Freiburg in 1510, and professor of theology at Ingolstadt in the same year. In 1512 he became chancellor of the university and canon of Eichstätt, and held these positions the rest of his life. Luther sent him a copy of his thesis, and he wrote in reply the *Obelisci* (1518). Carlstadt (q.v.) and Luther wrote replies to this work, and in 1519 occurred the memorable disputation at Leipzig, lasting from June 27 to July 16. In 1520 he visited Rome and urged upon the Pope, Leo X., to take strong measures against Luther. The Pope consented, and Eck returned with a papal bull of condemnation in his pocket. From this time on he was prominent among the opponents of the Reformation in Germany and Switzerland. In 1525 he visited England, and was well received by Henry VIII. He died at Baden, Switzerland, in 1527, with Haller of Bern and Œcolampadius of Basel, and attended the Augsburg Diet in 1530. He also took part in the religious convocations held at Worms in 1540 and at Regensburg in 1543. He died at Ingolstadt, Feb. 10, 1543. His most important works are included in *Operum Johannis Eccii contra Lutherum* (Augsburg, 1530-35). He prepared a German translation of the Old Testament and

adopted Emser's translation of the New. Consult Wiedemann, *Dr. Johannes Eck* (Regensburg, 1865).

**ECKARDT**, ɛk'ärt, JULIUS VON (1836-1908). A Russo-German author and diplomat. He was born at Wolmar (Livonia), was educated at the universities of St. Petersburg, Dorpat, and Berlin, and with Bärens published the *Rigasche Zeitung*, a journal which served as the chief exponent of the principles of the German Constitutional party in the governments of Esthonia, Livonia, and Courland. In 1867 he became a resident of Germany, where he was associated with Gustav Freytag, the well-known novelist, at Leipzig, in the publication of the *Grenzboten* (a newspaper) from 1867 to 1870. In 1884 he was appointed a privy councillor of Prussia, and after 1885 he was German Consul successively at Tunis, Marseilles, Stockholm, Basel, and Zurich. His publications include *Jungrussisch und Altlivländisch* (2d ed., 1871) and *Die baltischen Provinzen Russlands* (2d ed., 1877). Many anonymous works on Russian affairs are also ascribed to him.

**ECKARDT**. See ECKHART.

**ECKART**. See ECKHARDT.

**ECKEELS**, JAMES HEBRON (1858-1907). An American banker and financial expert, born at Princeton, Ill. He graduated at the Albany Law School (New York) in 1880, and practiced law at Ottawa, Ill., from 1881 to 1893. From 1893 to 1897 he was United States Comptroller of the Currency, and in the presidential campaign of 1896 was a leading Gold-Standard Democrat. He became president of the Commercial National Bank of Chicago in 1898. He published *The Financial Power of the New West* (1905).

**ECKER**, ALEXANDER (1816-87). A German anatomist and anthropologist. He was born at Freiburg and was educated at the university in that city and at Heidelberg and Vienna. He was professor of anatomy and physiology at Basel from 1844 to 1850, when he was called in the same capacity to Freiburg, where he formed a valuable anthropological collection. The Museum of Ethnology at Freiburg was also established by him. He was coeditor of the *Archiv für Anthropologie* and wrote the following publications: *Physiologische Untersuchungen über die Bewegungen des Gehirns und Rückenmarks* (1843); *Erläuterungstafeln zur Physiologie und Entwicklungsgeschichte* (1850-59); *Crania Germanica*, with 38 plates (1863-65); *Die Hirnwindungen des Menschen* (1869; 2d ed., 1882); *Die Anatomie des Frosches, ein Handbuch für Physiologen, Aerzte und Studierende* (3 parts, 1864-82; part i, 3d ed., parts ii and iii, 2d ed., 1896-1904); Eng. trans. by George Haslam, *The Anatomy of the Frog* (1889).

**ECKERMANN**, ɛk'ər-mán, JOHANN PETER (1792-1854). A German author known for his intimate relations with Goethe, born at Winsen. He served in the War of Liberation (1813-14) and afterward studied at Hanover and Göttingen. In 1822 he sent Goethe the manuscript of his *Beiträge zur Poesie mit besonderer Hinweise auf Goethe*. Goethe was favorably impressed with the work, and in the following year Eckermann went to Weimar and became Goethe's private secretary. He held several minor public offices in the grand duchy after Goethe's death, but is memorable solely for his *Gespräche mit Goethe* (1836-48), a translation of parts i and ii of which, by Margaret Fuller, appeared in

Boston in 1839, and a complete one by Oxenford in London (1850). There are translations in almost every European language, even Turkish. Eckermann published Goethe's *Nachgelassene Werke* (1832-33) and coöperated with Riemer in the edition of the *Sämtliche Werke*, in 40 volumes (1839-40).

**ECKERNFÖRDE**, ɛk'ər-n-fär'de. A town and seaside resort in the Province of Schleswig-Holstein, Prussia, Germany, on the Baltic, 20 miles northwest of Kiel by rail (Map: German Empire, C 1). It stands on a strip of land dividing Eckernförde Bay into two portions, and has a fine harbor. It is the headquarters of the Prussian fisheries, and carries on a thriving trade in agricultural produce, salt, iron goods, lumber, hardware, and tobacco. Its public institutions include a teachers' college, a trade school, and a school of architecture. Pop., 1900, 6719; 1910, 6802.

**ECKERSBERG**, ɛk'ɛrs-bɛrk, JOHAN FREDERIK (1822-70). A Norwegian painter. He was born at Drammen and studied at Düsseldorf under Schirmer, and afterward founded an important school at Christiania, Norway, in 1859. Among his works are "Sunrise in the High Mountains," a series of views of Madeira, where he lived some time for his health; "A View in Saeter Valley," in the Christiania Gallery, and a grand panoramic "Scene from a Norwegian Plateau," exhibited at the Paris Exhibition of 1867.

**ECKERSBERG**, KRISTOFFER VILHELM (1783-1853). A Danish painter, born at Varnaes, Schleswig. He studied in Copenhagen under A. W. Møller and in Paris under David, and from 1813 to 1816 lived in Rome, where he was strongly influenced by Thorvaldsen. On his return to Denmark he was made professor at the Academy of Copenhagen, and he founded the modern Danish school of painting. Although he lacks pictorial conception and imagination and uses dry and monotonous color, his sincere attitude towards nature and his good draftsmanship distinguish him above the artists of his day. He painted everything: biblical subjects, including "Moses Dividing the Waters of the Red Sea" (Copenhagen Museum); historical paintings, such as those in the throne room at Christiansborg; genre scenes, landscapes, marines and portraits, among which are the excellent and minutely executed likenesses of Anne Marie Magnani and Thorvaldsen.

**ECKERT**, ɛk'ɛrt (FRIEDRICH EDUARD), MAX (1868- ). A German cartographer and writer on commercial geography. He was born in Chemnitz, and was educated in Löbau and Berlin. He taught in Löbau and Leipzig; in 1903 became privatdocent in the University of Kiel, and in 1907 was appointed professor of geography in the Royal Technical High School of Aix-la-Chapelle. Among his publications are: an excellent *Schulatlas* (45th ed., 1912); *Wesen und Aufgabe der Wirtschafts- und Verkehrsgeographie* (1903); *Grundriss der Handelsgeographie* (1905); *Leitfaden der Handelsgeographie* (3d. ed., 1911); *Nepe Entwürfe für Erdkarten* (1906); *Die Kartographie als Wissenschaft* (1907); *The New Fields of Geography, especially Commercial Geography* (1907); *Geographisches Praktikum* (1908; with Krümmel); *Fortschritt in der geographischen Erschliessung unsern Kolonien* (1908 et seq.); *Die Kartenprojektion* (1910); *Deutsche Kulturgeographie* (1912); *Wirtschaftsatlas der deutschen Kolonien*

(1912): *Die wirtschaftliche Bedeutung des Panama-Kanals* (1913): *Die Metallverbreitung und Metallgewerbe der Welte* (1913).

**ECKERT, THOMAS THOMPSON** (1825-1910). An American telegrapher and . . . of telegraph systems, born in St. . . Ohio. He superintended the military telegraph office at General McClellan's headquarters in 1861, and held a similar position with the Army of the Potomac during the Peninsular campaign. In 1862 he organized the military telegraph service in the War Department buildings in Washington. At the close of the war he received the brevet rank of brigadier general, and from 1864 to 1866 was Assistant Secretary of War. He was superintendent of the eastern division of the Western Union Telegraph Company from 1866 to 1875, and was president of the Atlantic and Pacific Telegraph Company from 1875 to 1880, and of the American Union Telegraph Company from 1880 to 1881. On the consolidation of these two corporations with the Western Union, in 1881, he was elected vice president and general manager of the latter, in 1892 became president and manager, and retired early in 1902.

**ECKFORD, HENRY** (1775-1832). An American naval architect. He was born in Irvine, Scotland, and when 16 years old became a shipwright in the shipyards of his uncle, John Black, at Quebec. In 1796 he removed to New York and established a shipyard of his own. During the War of 1812 he constructed a fleet of ships of war upon Lake Erie in a remarkably short period of time. He was the builder of the *Robert Fulton*, which made the first successful ocean trip ever made by a steamship, from New York to New Orleans and Havana. In 1820 he was appointed naval constructor in charge of the Brooklyn Navy Yard, where he designed and superintended the construction of six ships of war. Leaving the service of the Government, he engaged again in shipbuilding on his own account, and constructed vessels for several European and South American countries. In 1831 he built a frigate at Philadelphia for the Sultan of Turkey, and accompanied it to Constantinople, where the Sultan offered him the position of chief constructor in his navy. He established a navy yard there, and, while engaged on plans for some new ships, died at Constantinople in the following year.

**ECKHARDT, Eckh rt, or ECKART, THE TRUSTY** (Ger. *der getreue Eckart*). In German legend, an old man whose doom it is to precede the spectral band of Frau Holle ("Die wilde Jagd"), in their wild ride through the country, and to warn all whom he meets, but especially children, of their approaching danger. According to another version Eckhart . . . at the entrance to the Venusberg, to dissuade those who would enter, and often attends the goddess on her journeys.

**ECKHART, or ECKARDT, JOHANNES** (c. 1260-1327). A noted German mystic, generally called Meister (Master) Eckhart. He was of the Dominican Order, and in 1298 became prior at Erfurt and vicar of Thuringia. In 1303 he was made provincial of his Order for Saxony, and in 1307 vicar-general of Bohemia. For several years he lectured at Paris. He was distinguished for practical reforms and for his power as a preacher. His writings show the results of contact with the Beghards (see BURGUES) and Brethren of the Free Spirit. The

opponents of the Beghards found some propositions in Eckhart's works for which he was called to account by the Inquisition at Cologne in 1327. He made a recantation and appealed to the Pope, by whom some of his propositions were formally condemned. Probably before the issuing of this condemnation Eckhart died. His works show that he was deeply learned in all the philosophy of the time, and a profound thinker. His style is without system, brief, mystical, and full of symbolical expressions; but his thinking was clear, calm, and logical, and he gave the most complete exposition of what may be called Christian pantheism. The starting point of his doctrine is that, apart from God, there is no real being. But, in his view, God is the unknown. Anything definitely ascribed to the Godhead would limit and therefore destroy its infinity. The Godhead is not God as known to us. From it proceeds the triune God, who is known. The *essence* of the Godhead is what it is in itself; its *nature* is that which it becomes as an object for others. It reveals itself in the personal God, the Father. The Son is the word or expression through and in which the Father becomes self-conscious. The Father eternally begets the Son, and the Son's return into the Father in love and mutual will is the Spirit. The Father is not before the Son; only through the begetting of the Son, only through arriving at self-consciousness, does He become the Father. The genesis of the Son from the Father involves also the production of the world of things; for God is reason, and in reason is contained the ideal world of creatures. In the Son all things are made in ideal form. As all things have arisen from God, so they all tend to return to Him. Repose in Him is the end of all things; and in man, the noblest of creatures, this end may be realized. Man has the power of reaching to the Absolute. This power—which Eckhart called the *spark*—is in truth God working in man. In . . . God and man are one; there is . . . of knower and known. Union with God—the birth of the Son in the soul—is the ultimate end of activity, and is to be attained by resigning all individuality. When this union is reached the soul is one with God; its will is God's; it cannot sin. Yet all this applies only to the "spark" in the soul, the other powers of which may be properly employed about other things. Thus, the way is left open to adjust the balance between feeling and action, between philosophical theory and practical life. Consult: Pf iffer, "Meister Eckhart," second volume of *Deutsche Mystiker* (Leipzig, 1857), containing a rich selection from his writings; Martensen, *Meister Eckhart* (Hamburg, 1842); Preger, *Geschichte der deutschen Mystik im Mittelalter* (Leipzig, 1874); *Meister Eckhart's mystische Schriften* (Berlin, 1903); *Schriften und Predigen* (Jena, 1909); Hartmann, *Die Geheimlehre in der christliche Religion nach den Erkl rungen von Meister Eckhart* (Leipzig, 1895); Vaughan, *Hours with the Mystics* (London, 1860).

**ECKHART, JOHANN GEORG VON** (1664-1730). A German historian, born at Duingen. He studied at Leipzig, in 1694 became an assistant to Leignitz in the latter's historical studies, and in 1706 professor of history at Helmstedt. Elevated to the nobility, he was in 1724 appointed librarian at the court of the prince-bishop of W rzburg. Among his works are the *Corpus Historicum Medii  vi* (1723) and the

*Commentarii de Rebus Franciæ Orientalis et Episcopatus Wirceburgensis* (1729), long-standing authorities on the times of which they treat.

**ECKHEL**, ĕk'el, JOSEPH HILARIUS (1737-98). An eminent Austrian numismatist, born at Enzersfeld. He was educated at the Jesuits' College in Vienna, and in 1751 entered the society. His knowledge of numismatics soon won him the place of keeper of coins and medals in the Jesuits' College at Vienna. In 1772 he went to Italy, where for two years he was engaged in the study of coins; on his return to Vienna he was made director of the Imperial Cabinet of Medals and professor of archæology at the university. Beginning with 1775, he published numerous works on coins and gems, but his greatest work is his *Doctrina Numorum Veterum* (8 vols., 1792-98). A supplementary volume was added in 1826 from papers left by Eckhel at his death; this volume also contains an account of his life and writings. By his great work Eckhel became the founder of scientific numismatics. Consult Sandys, *A History of Classical Scholarship*, vol. iii (Cambridge, 1908). See NUMISMATICS, *History of Numismatic Studies*.

**ECKHOF**, ĕk'hôf, KONRAD. See ERHOF.

**ECKMÜHL**, ĕk'mül, or **EGGMÜHL**. A village of Bavaria, on the Grosse Laber, 13 miles south-southeast of Ratisbon, noted for the battle fought there on April 22, 1809, between 75,000 French and 40,000 Austrians. The Austrian Archduke Charles had taken up his position on the right bank of the Danube, near Ratisbon. From this point, at the head of four divisions of the Austrian army, he threatened the French position at Donauwörth. Davout, however, succeeded in keeping him in check, while Napoleon, swinging round to the southeast, interposed himself between the road to Vienna and the Austrian army, with which he came face to face at Eckmühl. The action on the side of the French was commenced by Lannes, who drove back the Austrian left, while at the same time the village of Eckmühl was stormed by the Württembergers. Shortly afterward the high grounds between Eckmühl and Laichling, also occupied by the Austrians, were abandoned after an heroic struggle, and the Archduke ordered a retreat on Ratisbon, which was admirably executed, though at the sacrifice of the entire Austrian cavalry, who were cut to pieces at Eylofstein while covering the movement. The Austrians lost nearly 30,000 men at Eckmühl and in the two days' fighting that preceded it. The French loss was much less.

**ECKMÜLL**, PRINCE OF. See DAVOUT.

**ECKSTEIN**, ĕk'stĕn, ERNST (1845-1901). A versatile German humorist, poet, and novelist, born at Giessen. His first literary work, *Schach der Königin* (1870) and *Pariser Silhouetten* (1873), was done in France, as were the grotesque *Die Gespenster von Varzin* (1870) and *Der Stumme von Sevilla* (1871). His travels in Italy and Spain resulted in the stories *Margherita*, *Am Grabmal des Cestius*, and *Die Moschee von Cordova*. He returned to Germany, lived for several years in Leipzig as editor of a literary journal and of a comic weekly, and wrote many brilliantly humorous sketches, of which the side-splitting *Besuch in Carcer* is typical. In 1885 he moved to Dresden, and afterward wrote several serious novels of classical life, among which *Die Claudier* (1882), *Prusias* (1883), *Aphrodite* (1886), *Pia* (1887), and *Nero* (1889) are noteworthy. *Familie*

*Hartwig* (1894) is his best novel. His lyrics are carefully polished, and some of his translations are models.

**ECLECTICISM** (from *eclectic*, from Gk. ἐκλεκτικός, *eklektikos*, selecting, from ἐκλέγειν, *eklegein*, to select, from ἐκ, *ek*, out + λέγειν, *legein*, to gather). In philosophy, an attempt to piece together from various competing systems such elements as may, to superficial view, appear fairly compatible. The prevailing motive is usually practical, being a desire to get a set of opinions which shall lend their support to moral and religious life. Eclecticism appears wherever great speculative power is wanting at the same time that the conflict between traditional schools is vigorously carried on without much appreciation of the reach of the principles involved. Under such conditions many thinkers prefer to keep out of the strife of the schools, and endeavor to satisfy their not very exacting intellectual demands by selecting here and there what appears to go together to form a satisfactory intellectual foundation for the needs of this life. In ancient philosophy, Cicero was the most conspicuous if not the greatest representative of this tendency, adopting elements from the Skeptic, the Stoic, and the Peripatetic schools without obtaining any systematic outcome from this combination. From his day to this, eclectics have been numerous. Cousin (q.v.) is often called the great modern eclectic, but perhaps this characterization fails to do justice to his desire to get a consistent system rather than a merely edifying one. Every great philosopher gathers his materials wherever he finds them. He is not troubled by the fact that he finds them in mutually hostile territories. But what distinguishes him from the eclectic is his desire to know what is true rather than to believe what is helpful, and above all his ability to weave his materials together into a consistent fabric.

**ECLECTIC SCHOOL OF MEDICINE**, **AMERICAN, OR NEW SCHOOL OF MEDICINE**. The modern representative of a school of medical thought which existed as early as 200 B.C. Its adherents contended that the wisdom of the various schools was a vain thing, and that the individual could choose for himself between the good and the bad. They, therefore, rejected all knowledge gained by the experience of others. The modern revival took place in America in the early part of the nineteenth century. The modern eclectic professes still to take what is best in medicine, and is still an individualist. In 1826 an eclectic college was founded in New York by Wooster Beach, who was the author of several textbooks for the school. Soon afterward schools were established in Ohio and other States, and at a later period regular colleges in New York, Chicago, and other cities. State societies were formed, and in 1870 the National Eclectic Medical Association was incorporated by the New York Legislature. In 1914 the United States contained 4 eclectic colleges, with 270 students. The prominent feature of the school is the theoretical rejection of mercury and most other mineral substances in medicine. Another distinctive point in modern eclectic practice is the use of native medicinal plants, and from the studies of some American eclectic teachers much useful information has been gained respecting these plants. Consult Beach, *The American Practice of Medicine* (New York, 1838), and Wilder, *History of Medicine* (New Sharon, Me., 1901).

**ECLECTIC SCHOOL OF PAINTING.** See BOLOGNESE SCHOOL OF PAINTING.

**ECLIPSE** (Lat. *eclipsis*, from Gk. *ἐκλειψις*, *ekleipsis*, eclipse, from *ἐκλείπειν*, *ekleipein*, to forsake, fail, from *ἐκ*, *ek*, out + *λείπειν*, *leipein*, to leave). Sometimes one or other of the self-luminous heavenly bodies is shut off from our view temporarily by the interposition of some other body between it and the earth. This is called an eclipse when the object temporarily obscured is the sun, and an occultation (q.v.) when it is a star. Nonluminous bodies, which shine only by reflected solar light, may be "eclipsed" by having the light cut off by a body passing between themselves and the sun; and they may be "occulted" by being concealed behind a body passing between themselves and the earth. The term "transit" is applied to the partial concealment of the sun by the passage across his face of Venus or Mercury, and to the similar phenomena of the passages of Jupiter's satellites across his disk. The causes of eclipse as here suggested are so simple and familiar that it is difficult for us to imagine how deeply eclipses affected men's minds before the dawn of astronomical science. At Rome, at one time, it was a crime, and punished by law, to talk publicly of eclipses being due to natural causes. According to some, Luna, when in eclipse, was in the pains of labor; according to others, she was suffering from the arts of wicked magicians. The Chinese imagine eclipses to be caused by great dragons trying to devour the sun and moon, and accordingly they beat drums and brass kettles to terrify the monsters into letting go their prey. Chinese annals of the 22d century B.C. record that, on the occasion of a solar eclipse which took place in the reign of the Emperor Chung K'ang, the state astronomers, Hsi and Ho, were drunk and incapable of attending to their duties as supervisors of the prescribed rites, and were, in consequence, put to death. Solar eclipses can occur only at the time of new moon, when the sun and moon are in conjunction on the same side of the earth. In a partial eclipse, the sun's disk suddenly loses its circular form; it becomes indented on one side, the indentation slowly increasing for some time, and then diminishing until it disappears altogether. In a total eclipse, the indentation goes on increasing till the whole orb disappears for a time; after a short interval, the sun reappears again, passing through the same phases of obscuration in an inverse order. In an annular eclipse, the whole sun is obscured except a ring or annulus. Lunar eclipses, on the other hand, always occur at full moon, or when the sun and moon are in opposition, and are caused by the moon passing through the earth's shadow. Such eclipses are sometimes partial and sometimes total, but never annular, and in their general phases they resemble those of the sun. The duration of an eclipse is the time of its continuance, or the interval between immersion and emersion. Immersion, or incidence, of an eclipse is the moment when part of the luminary begins to be obscured; emersion is the time when the luminary begins to reappear or emerge from the shadow. When the size of an eclipse is mentioned, the part of the luminary obscured is obtained by dividing its diameter into 12 digits; and the eclipse is said to be of so many digits, according to the number of them contained in that part of the diameter which is obscured.

**Eclipses of the Moon.** It has been said that

these are caused by the moon passing through the earth's shadow. Before this explanation can be accepted, it must be shown that that shadow extends as far as the moon. This is easily done. Supposing the earth to have no atmosphere, then the shadow is the cone marked in shade in Fig. 1, in which *T* and *S* are the centres of the earth



FIG. 1.

and sun. The cone's apex is at *O*; and the question is, whether the distance *OT* from the apex to the earth's centre exceeds the moon's distance from the earth. Drawing *TB*, *SA*, from the centres of the earth and sun, respectively, perpendicular to the line *OB**A*, tangent to both spheres, and the line *TC* parallel to the line *OB**A*, we have from the similar triangles *OTB* *TSC*, the proportion, *OT* : *TB* :: *TS* : *SC*. Now, we know that *TS*, the (mean) distance of the sun, is equal to about 24,000 times *TB*; also, from the construction, *AC* = *TB*; and we know that *SA* = 112 times *TB*; whence it follows that *SC* = 111 times *TB*. The above proportion then gives *OT* = 216 times *TB*, since  $\frac{24,000}{111} = 216$  nearly. But the moon's average distance is only 60 times *TB* (the earth's radius). Hence it appears that the length of the earth's shadow is almost four times the average distance of the moon, and that the moon can enter it. Further, it is clear that, should it do so, it may be totally obscured; for it must enter at a point much nearer *T* than half the distance *OT*, which is 108 times *TB*; and everywhere within that distance, it might be shown, the breadth of the shadow is much greater than the moon's disk. But one consideration now remains to be stated to complete the proof of the theory of lunar eclipses. It was mentioned that they only occur at full moon, and we know that to be the only time when the earth is between the sun and moon, and so has a chance of throwing her shadow upon it. Why they do not occur every full moon will be explained in treating of the prediction of eclipses.

In the foregoing explanation, we proceeded on the assumption that the earth has no atmosphere. If the assumption were correct, the earth's shadow would be darker and narrower than it is, and the phenomena of eclipses more sudden. The effect of atmospheric refraction (see REFRACTION) is to bend the rays which fall on the atmosphere in towards the axis of the cone of the earth's shadow, those which pass through the lowest strata of the air being refracted through an angle of  $1^{\circ} 8'$ , and converging to a point in the line *OT* (Fig. 1) considerably nearer the earth than the point where the moon crosses her shadow. As a result of this, the moon never enters that part of the shadow which is completely dark; thus, she never loses her light entirely, but appears of a distinct reddish color resembling tarnished copper—an appearance caused by the atmospheric refraction in the same way as the ruddy color of the clouds at sunset. There is another reason why the phenomena of a lunar eclipse are less striking than might be expected from the explanation given relative to Fig. 1. Every shadow cast by the sun's rays



necessarily has a penumbra, or envelope, on both sides of the central cone. In the case before us (Fig. 2), suppose a cone having its apex

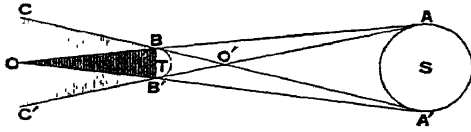


FIG. 2.

$O'$  between the sun and the earth, and enveloping each of them respectively in its opposite halves  $CO'C'$  and  $AO'A'$ . It is clear that from every point in the shaded part of the cone  $CO'C'$  but without the shadow  $BOB'$ , a portion of the sun will be visible—and a portion only—the portion increasing as the point approaches either of the lines  $CB$ ,  $C'B'$ , and diminishing as it approaches the lines  $BO$ ,  $B'O$ . In other words, the illumination from the sun's rays is only partial within the space referred to, and diminishes from its extreme boundary line towards the lines  $BO$ ,  $B'O$ . When, then, the moon is about to suffer eclipse, it first loses brightness on entering this penumbra; so that when it enters the real shadow, the contrast is not between one part of it in shade and the other in full brilliancy, but between a part in shade and a part in partial shade. On its emersion, the same contrast is presented between the part in the umbra and the part in the penumbra. What we should expect on this geometric view of the earth's shadow, actually happens. From the breadth of the penumbra, it happens that the moon may fall wholly within it before immersion in the umbra commences; and so softly do the degrees of light shade into one another, that it is difficult to tell when a remarkable point on the moon's surface leaves the penumbra to pass into the umbra, or the reverse.

**Prediction of Lunar Eclipses.** We said that lunar eclipses happen only at full moon. They do not happen every full moon, because the moon's orbit is inclined to the ecliptic, on which the centre of the earth's shadow moves at an angle of  $5^\circ 9'$  nearly. Of course, if the moon moved on the ecliptic, there would be an eclipse every full moon; but from the magnitude of the angle of inclination of her orbit to the ecliptic, an eclipse can only occur on a full moon happening when the moon is at or near one of her nodes, or the points where her orbit intersects the ecliptic. An eclipse clearly can happen only when the centres of the circle of the earth's shadow and of the moon's disk approach within a distance less than the sum of their apparent semidiameters. This sum is very small; so that except when near the nodes, the moon, on whichever side of the ecliptic she may be, may pass above or below the shadow without entering it in the least. The moon's average diameter is known to be  $31' 8.2''$ , and from the *American Ephemeris*, or the *British Nautical Almanac*, we may ascertain its exact amount for any hour—its variations all taking place between the values  $29' 24''$  and  $33' 32''$ . As for the diameter of the circle of the shadow, as seen from the earth's centre, it is easily found by geometric construction and calculation and is shown to vary between  $1^\circ 16' 36''$  and  $1^\circ 30' 38''$ ; and its value for any time may be found from the *American Ephemeris*, or the *British Nautical Almanac*, to which value astronomers usually add about

$1' 30''$ , as a correction for their calculation, which proceeds on the assumption that the earth has no atmosphere. Starting from these elements, it is a simple problem in spherical trigonometry (which may be solved approximately by plane trigonometry by supposing the moon and the earth's shadow to move for a short time near the node in straight lines) to fix the limits within which the shadow and moon must concur to allow of an eclipse. Recollecting that the earth's shadow on the ecliptic is at the opposite end of the diameter from the sun, and that therefore as it nears one node the sun must approach the other—the sun and shadow being always equidistant from the opposite nodes—we find, from the solution of the above problem: (1) that if, at the time of full moon, the distance of the sun's centre from the nearest node be greater than  $12^\circ 15'$ , there cannot be an eclipse; (2) if at that time the distance of the sun's centre from the nearest node be less than  $9^\circ 30'$ , there will certainly be an eclipse; (3) if the distance of the sun's centre from a node be between these values, it is doubtful whether there will be an eclipse, and a detailed calculation must be resorted to, to ascertain whether there will be one or not. It may here be mentioned that before the laws of the solar and lunar motions were discovered with anything like accuracy, the ancients were able to predict the dates of lunar eclipses with tolerable correctness by means of the eclipse cycle or Saros (see PERIOD) of 18 Julian years and 11 days. Their power of doing so turned on this, that in 223 lunations the moon returns almost to the same position in the heavens. If she did return to exactly the same position, then, by simply observing the eclipses which occurred during the 223 lunations, we should know the order in which they would recur in all time coming.

All lunar eclipses are visible in all parts of the earth which have the moon above their horizon, and are everywhere of the same magnitude, with the same beginning and end; and this universality of lunar eclipses is the reason why it is popularly thought, contrary to fact, that they are of more frequent occurrence than solar eclipses. The eastern side of the moon, or left-hand side as we look towards her from the north, is that which first immerses and emerges again. The reason of this is that the motion of the moon is swifter than that of the earth's shadow, so that she overtakes it with her east side foremost, passes through it, and leaves it behind to the west. It will be readily understood from the explanations above given that total eclipses of the longest duration happen in the very nodes of the ecliptic. But from the circumstance of the circle of the shadow being much greater than the moon's disk, total eclipses may happen within a small distance of the nodes, in which cases, however, their duration is less. The farther the moon is from her node at the time, the smaller is the eclipse, till, in the limiting case, she just touches the shadow, and passes on unobserved.

**Eclipses of the Sun.** These are caused, as we have stated, by the interposition of the moon between the earth and sun, through which a greater or less portion of the sun is necessarily hid from view. By a process similar to that used in ascertaining the length of the earth's shadow, it can be shown that the greatest value of the length of the moon's shadow is about 60

semidiameters of the earth; at the same time, we know that the least distance of the moon from the earth is about 56 semidiameters. It follows that when a conjunction of the sun and moon happens at a time when the length of the shadow and the distance of the moon from the earth are, or are nearly, equal to the value above stated, the moon's shadow extends to the earth and beyond it. Should the shadow in these circumstances fall upon the earth, there will be a total eclipse of the sun in all places



FIG. 3.

within it or over which it moves. If  $L$  (Fig. 3) be the moon,  $T$  the earth, and  $abL$  the moon's shadow cast by the sun, there will be a total eclipse of the sun at every point that is completely within the portion  $ab$  of the earth's surface. Again, the smallest value of the length of the moon's shadow may be shown to be about 58 semidiameters of the earth, and the greatest distance of the moon from the earth is about 64 semidiameters. Suppose the moon interposed between the earth and sun when these values concur, it is clear that the moon's shadow will fall short of the earth. In this case, the sun cannot be altogether hid from any point of the earth's surface; but this case, or one approximate to it, is that in which there will occur an annular eclipse. In Fig. 4, suppose  $O$  to be the

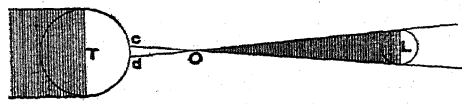


FIG. 4.

apex of the shadow which falls short of the earth, and conceive the cone of the shadow produced earthward beyond  $O$  into a second cone  $Ocd$ ; then from every point within the section  $cd$  of the earth's surface the moon will be seen projected as a black disk on the middle of the disk of the sun, the portion unobscured forming a ring or annulus of light. While in the two cases just described the eclipse is total or regular at places within  $ab$  (Fig. 3) or  $cd$  (Fig. 4), respectively, it will be partial at other places; the moon will appear projected against a portion of the sun's disk, making a circular indentation. To ascertain the places at which the eclipse will be partial, we have merely to form the cone of the penumbra of the moon's shadow in the manner explained in treating of lunar eclipses; at all places on the earth's surface within that cone there will be a partial eclipse. A simple calculation shows what is the observed fact, that the cone of the penumbra is not nearly large enough to embrace the whole of the face of the earth directed to the sun; in other words, solar eclipses are not universal, like those of the moon, i.e., they are not seen from all places that have the sun above their horizon at the time of the eclipse, which is the reason that though they are of more frequent occurrence than lunar eclipses, the latter are more frequently seen by the public, and there-

fore commonly supposed to occur more frequently. There are certain appearances, attending an eclipse of the sun, when it is total, that are very remarkable. The darkening of the orb of day, more particularly when it is unlooked for, is calculated to impress a spectator with vague terror; even when expected, it fills the mind with awe. The sudden darkness, too, is impressive from its strangeness; it resembles neither the darkness of night nor the gloom of twilight. Stars and planets appear, and all animals are dismayed by the gloomy aspect of nature.

There is one important phenomenon attending total eclipses of the sun, which is always seen and the cause of which cannot be said to be as yet fully understood. As long as the total eclipse lasts there appears round the sun and moon a luminous corona, while at its base, and projecting beyond the dark edge of the moon, appear very brilliant prominences, generally of a red color. These prominences are found to be constant attendants on eclipses, and methods have been invented for rendering them visible at any time without the interposition of the moon. The spectroscope shows that they consist mainly of hydrogen gas in an incandescent state. The prominences are sometimes seen to shoot up like flames, in wild fantastic shapes, with incredible velocity, and to the height of hundreds of thousands of miles.

The first eclipse photographs of the sun were obtained at the eclipse of 1851, but it was not until that of 1860 that photography was systematically employed in the observation of solar eclipses. On that occasion De La Rue and Father Secchi, at different stations in Spain, secured photographs which definitely established the chromosphere as a solar appendage. The Indian eclipse of 1868 saw the spectroscope added to the instrumental resources of the eclipse observer, and the gaseous nature of the chromosphere and its prominences was revealed when the bright lines due to hydrogen were observed; another important discovery was that of the orange line of helium which, however, was attributed at the time to the presence of sodium in the chromosphere. In the North American eclipse of 1869 the corona yielded a continuous spectrum traversed by a single green line, which was at first identified with one of the iron lines, but is now recognized as due to an element unknown to terrestrial chemistry, to which the name "coronium" has been given. The Spanish eclipse of 1870 was marked by Young's discovery of the "reversing layer." In recent years no total eclipse, if at all accessible, has been allowed to pass without the dispatch of several expeditions, usually manned by astronomers from the leading observatories, but occasionally due to private initiative, and, except in a few cases where adverse weather conditions have led to failure, each has added confirmation of previous discoveries, or has raised new questions the solution of which has been left to succeeding expeditions. See CHROMOSPHERE; SUN.

**Prediction of Solar Eclipses.** The period of 18 Julian years 11 days, referred to in treating of the prediction of lunar eclipses, applies equally to solar eclipses; but the ancients, who understood that fact, could find no law of recurrence of solar eclipses within that period so as to predict them. The reason of the failure is obvious; for though solar eclipses recur in a

fixed order within the cycle, they are not visible at the same places on their recurrence as when first observed. By modern methods, however, eclipses of the sun may be predicted, with all their circumstances of time and places of observation, with the most perfect certainty. At the time of a solar eclipse the sun and moon are in conjunction; they are also in or near the same node; and no eclipse can happen if they are farther than  $18^{\circ} 31'$  from the node, or if the latitude of the moon, viewed from the earth, exceeds the sum of the apparent semi-diameters of the sun and moon. When within these limits, it is a problem of numbers and of spherical trigonometry to ascertain whether an eclipse will occur and what its circumstances will be.

The number of eclipses of the sun and moon together in a year cannot be less than two—in which case both are solar—or more than seven, five solar and two lunar, or four solar and three lunar; but total solar eclipses are extremely infrequent in any one place, compared with the actual frequency of their occurrence. Thus, total eclipses were visible somewhere in the United States during the nineteenth century only in the years 1806, 1834, 1860, 1869, 1878, 1880, 1889, 1900: and in the present century such eclipses will be visible in the years 1918, 1923, 1925, 1945, 1954, 1979, 1984, and 1994. For a very complete list of eclipse dates, consult Newcomb, "On the Recurrence of Solar Eclipses, with Tables of Eclipses from 700 B.C. to 2300 A.D.," in *Astronomical Papers* (Washington, 1882), and Oppolzer, *Kanon der Finsternisse* (Vienna, 1887).

**Notable Eclipses of Antiquity.** Besides the solar eclipse already referred to as having been the occasion of the death of the Chinese astronomers, Hsi and Ho, many other notable eclipses, both of the sun and the moon, are recorded in history. Several are mentioned in Babylonian and Assyrian annals, one of the best authenticated being a total eclipse of the sun which took place at Nineveh on June 15, 763 B.C. On May 28, 585 B.C., occurred the famous eclipse predicted by Thales of Miletus, which is said to have put a stop to the battle of the Halys between the Medes and Lydians. Thucydides mentions an annular eclipse of the sun which took place on Aug. 3, 431 B.C., during the first year of the Peloponnesian War; and another is recorded in 394 B.C. as occurring a few days after the sea fight off Cnidus in which Conon defeated the Persians. The Carthaginian expedition of Agathocles, the Tyrant of Syracuse, landed in Africa during a total eclipse of the sun in 310 B.C. During the Third Macedonian War Sulpicius Gallus, one of the Roman officers, foretold a total eclipse of the moon which occurred on the eve of the battle of Pydna in which the Romans in 168 B.C. defeated Perseus, the Macedonian King; it is said that he announced the coming eclipse to the assembled army, that it might not be regarded as a bad omen. Several eclipses find mention in the *Anglo-Saxon Chronicle* and are associated by the chronicler with notable contemporaneous events. A complete list of eclipses from 900 B.C. to 600 A.D., with identifications with recorded eclipses, may be found in Ginzel, *Spezieller Kanon der Sonnen- und Mondfinsternisse* (Berlin, 1899). Consult: Lockyer, *Recent and Coming Eclipses* (New York, 1900); Buchanan, *Mathematical Theory of Eclipses* (Phil-

adelphia, 1904); Lynn, *Remarkable Eclipses* (London, 1906).

**ECLIPTIC** (Lat. *eclipticus*, from Gk. *ἐκλειπτικός*, *ekleiptikos*, relating to an eclipse, from *ἐκλείψω*, *ekleipsis*, eclipse). The great circle of the heavens round which the sun seems to travel from west to east in the course of a year. It took its name from the early observed fact that eclipses (see ECLIPSE) happen only when the sun and moon are in or near this circle. Attention about sunset or sunrise shows that the sun is constantly altering his position among the stars visible near him, leaving them every day a little farther to the west. That this motion is not exactly east and west, or parallel to the celestial equator, becomes evident by observing that the sun's height at midday is constantly altering. It was discovered very early in the history of astronomy that twice a year, about March 21 and September 23, the sun is exactly on the equator. The two points of the equator on which the sun then stands are the equinoctial points (see EQUINOXES; EQUINOCTIAL) and are the intersections of the equator and ecliptic. Again, there are two days in the year on which the sun reaches his greatest and his least midday elevation in the Northern Hemisphere—the first is the 21st of June; the second, the 21st of December. On these days the sun has reached his greatest distance from the equator either way, and the points in his course where he thus seems to pause or halt in his retreat from the equator are called the solstices (*solis stationes*). The solstices are halfway between the equinoxes, so that these four points divide the ecliptic into four quadrants, each of which is divided into three arcs of  $30^{\circ}$ . The 12 arcs into which the ecliptic is thus divided are called signs of the zodiac (q.v.). These arcs or signs have been named after constellations through which the ecliptic passes. As the equinoctial points are not fixed, but recede yearly westward about  $50''$ , and in the century about  $1^{\circ} 24'$ , the same constellations and signs that coincided when the division of the ecliptic took place no longer coincide. The constellation of the Ram, e.g., which originally stood in the first arc or sign, now stands in the second, every constellation having advanced forward  $30^{\circ}$ , or a whole sign. Modern astronomers therefore pay little attention to these constellations and signs, but measure celestial longitudes from the existing spring equinoctial point, reckoning them from  $0^{\circ}$  to  $360^{\circ}$ . Not only do the points change where the ecliptic and equator cross each other, but the angle between these two circles, called the obliquity of the ecliptic, is also variable. It is at present nearly  $23.5^{\circ}$  and is diminishing at the rate of about  $50''$  in a century. Were it to go on diminishing always, the ecliptic and the equator would at last coincide. The decrease, however, has a limit; the obliquity oscillates between two definite bounds, which it can never pass. It has been calculated that the diminution will continue for about 150 centuries, when the obliquity will amount to only  $22.25^{\circ}$ . After that it will again increase, tending towards an upper limit of about  $25^{\circ}$ . These slight alterations cannot sensibly affect the seasons.

The physical cause of this change of the obliquity is the gravitational action of the other planets, especially Jupiter, Mars, and Venus, on the mass of the earth. The fact of the change was known to astronomers in very

ancient times; Herodotus mentions an old tradition of the Egyptians that the ecliptic had formerly been perpendicular to the equator—a notion into which they were most probably led by observing for a long series of years that its obliquity was constantly diminishing. Though it was not until after the discovery of the law of gravitation that the change of the obliquity could be explained, yet that it was changing was long believed by many astronomers, although some doubted whether the differences in the values at different times were not due to errors of observation. The earliest-known measure of the obliquity of the ecliptic was probably made in China.

**ECLOGITE** (from Gk. *ἐκλογος*, *eklogos*, selected, from *ἐκλέγειν*, *eklegein*, to select, from *ἐκ*, *ek*, out + *λέγειν*, *legein*, to gather). A variety of metamorphic crystalline rock, remarkable for its composition and great beauty. It has a ground mass of pale-green pyroxene and hornblende, in which reddish crystals of garnet and blue crystals of cyanite are included. The rock is of rare occurrence, being found only in a few regions where Archæan gneisses and schists are exposed. The type locality for eclogite is the Bavarian Fichtelgebirge.

**ECLOGUE** (Lat. *ecloga*, Gk. *ἐκλογή*, *eklogē*, selection, from *ἐκλέγειν*, *eklegein*, to select). A pastoral poem, in which are related the loves and adventures of shepherds and shepherdesses in some ideal scene and period. This kind of poetry flourished among the ancients, Theocritus and Vergil being well-known examples. Under the name of pastorals, eclogues were fashionable in the sixteenth century. A good English specimen is Spenser's *Shepherd's Calendar*. They were revived in the eighteenth century by Ambrose Philips and Pope, but are no longer written. The term, however, is still applied to poems descriptive of country life and scenes. For the recent treatment of the eclogue, consult Bridges, "New Poems," in *Poetical Works* (London, 1899). See PASTORAL POETRY.

**ECNOMUS**. A hill near Licata, on the southern coast of Sicily, which gave its name to the famous naval battle in which Regulus in 256 B.C. vanquished the Carthaginians.

**ÉCOLE DES BEAUX-ARTS**, *â'kôl' dâ bô'zâr'* (properly ÉCOLE NATIONALE ET SPÉCIALE DES BEAUX-ARTS). The national school of the fine arts in France, probably the most important institution of the kind in the world. It was founded in 1648, coincidentally with the Académie Royale de Peinture et de Sculpture, as the academic school where each professor in turn gave instruction in drawing. It did not receive its official title until 1793. Since then the only changes have been in the form of its administration. In 1815 the Académie des Beaux-Arts was given its present name, and in 1863 the outside ateliers, which are practically workshops, were added to the main Ecole. The Academy judges the yearly competition for the Prix de Rome (q.v.), directs the Academy at Rome, and has charge of the Ecole generally. The Academy of Architecture was annexed to the Academy of Painting and Sculpture in 1671, with François Blondel as its first professor, and was incorporated into the Académie des Beaux-Arts in 1793. The School of Architecture is now one of the most important branches of the Ecole des Beaux-Arts. In 1666 the Prix de Rome was instituted, and in the same year the Académie de France at Rome

was established by Colbert, with the practical assistance of Charles Errard (q.v.), its first director. By the study of the antique the student perfects himself in form and line and attains that skill in drawing and composition for which the Ecole has always stood, even to the detriment of color, and which, more than any other factor, has influenced French art. The site of the Academy since 1803 has been the Villa Medici, on the Pincian Hill.

The courses in drawing, painting, sculpture, architecture, engraving, modeling, and gem cutting at the Ecole des Beaux-Arts are free to both men and women between the ages of 15 and 30. Foreigners, not being eligible for the Prix de Rome, are not subject to the age regulation. The student who passes the examinations in any one of the courses must already have had experience in some special branch of art. The whole system of teaching at the Ecole is by means of competitions, and the grade obtained in these marks the student's relative advancement. The outside ateliers are in charge of the professors or "patrons," and in order to enter these the student pays a small fee. Some of his work is required to be done *en loge*, but much may be worked up in the ateliers. The regular course is nominally from 8 to 10 years, but a student may remain as long or short a time as he pleases, provided he visit the school twice a year, in order to keep his name on the rolls. The whole number of students in the school is approximately 2000, most of whom are French. The number of Americans who enter is larger than that of any other foreign nation, and the influence of the Ecole on American art and artists has been very great. The teachers, of whom there are (1913) 31 in the Ecole proper and 17 in the ateliers, besides the director (in 1914 Léon Bonnat) and administrative officers, are selected from among the most celebrated French artists. But they are paid a purely nominal fee, the equivalent of \$240 in our money, for work which takes them two half days each week of the school year.

The Palais des Beaux-Arts, the home of the Ecole, on the Quai Malaquais, was begun by Debret in 1820 and finished by Duban in 1863. It contains a noted collection of copies of famous paintings made by the winners of the Prix de Rome, casts of statues and models of ancient buildings, drawings by old masters, and the Hémicycle of Delaroche (q.v.). Consult: Delaborde, *L'Académie des Beaux-Arts* (Paris, 1891); Béraud, *Annales de l'Ecole française des Beaux-Arts* (Paris, 1828); Montaiglon, *Mémoires pour servir à l'histoire de l'Académie Royale de Peinture et de Sculpture depuis 1648-1664* (ib., 1853); Vitet, *L'Académie Royale de Peinture et de Sculpture, Etude historique* (ib., 1861); Lenoir, *Histoire des arts en France* (ib., 1811); Penarun, Roux, and Delaire, *Les architectes élèves de l'Ecole des Beaux-Arts* (ib., 1895); *Architectural Record* (Beaux-Arts No., January, 1901); Flagg, "Ecole des Beaux-Arts," *Architectural Record*, vol. iii.

**ÉCOLE DES FEMMES**, *â'kôl' dâ fâm*, *l'* (Fr., The School of Wives). A five-act comedy by Molière, produced at the Palais Royal, Dec. 26, 1662.

**ÉCOLE DES MARIS**, *dâ mâ'rê'*, *l'* (Fr., the School of Husbands). A three-act comedy in verse by Molière, produced at the Palais Royal in 1661. The general idea of the piece is borrowed from the *Adelphi*, of Terence, and details

are taken from Boccaccio and probably from Lope de Vega's *Discreta enamorada*.

**ÉCOLE POLYTECHNIQUE**, pól'è'tèk'nèk' (Fr., Polytechnic School). See MILITARY EDUCATION.

**ECOL'OGY**, or **ÆCOL'OGY** OF PLANTS (from Gk. *oikos*, house + *-logia*, *-logia*, discourse, from *λέγειν*, *legein*, to say). That division of botany which has to do with the mutual relations between plant organisms and their environment. Until recently the subject matter of ecology has not been systematically treated, although certain phases of the subject, such as pollination, seed dispersal, protection, symbiosis, have been for some time grouped together and denominated "biology," especially by German authors, as Kerner (1887), Wiesner (1889), and Ludwig (1895). The first to treat ecology systematically was Warming, of Copenhagen, who in 1895 gave a résumé of the ecological factors and their influence and discussed the ecological plant geography of the world, dividing plants into four groups, viz., hydrophytes, mesophytes, xerophytes, and halophytes (q.v.). In 1898 Schimper gave a much more extended treatment of the world's vegetation, but from a slightly different point of view, basing his main subdivisions on temperature and discussing in each subdivision the ecological relations of the three types of climatic formations (forest, grassland, desert), and also, but very briefly, of the edaphic formations or groups of plant associations.

Ecology is even yet imperfectly organized, but at present two main aspects of the subject are recognized, and these are in their turn more or less subdivided according to different authorities. These aspects are: 1. Autecology, or the ecology of plants as individuals, i.e., the relation of these plants, their tissues and organs, to their environment, including the variations which result. This phase of ecology is often quite rightly regarded as inseparably connected with plant physiology. Autecology has two principal subdivisions: anatomical ecology, which deals with the origin, development, function, and variations of plant tissues; and organographic ecology (usually termed simply organography), which concerns itself with the origin, development, and meaning of plant organs. 2. Synecology, the ecology of plant communities, investigates plants as they are associated in the vegetation covering the earth. It recognizes the fact that plants exist not only as individuals, but also members of communities that have an origin, a life history, and a more or less prolonged duration, and, further, that these communities are of various different ranks and develop as definite responses to various factors. It may be subdivided into physiographic ecology, dealing with the origin, development, and history of plant associations, their relationship to the local physiography, and the combination of these plant associations to form the larger plant communities known as plant formations; and geographic ecology, or ecological phytogeography, the study of the great forest, grass, and desert formations of the globe in relation to climatic factors. This latter subdivision is closely related to the geography and is conveniently discussed under the head of DISTRIBUTION OF PLANTS (q.v.).

Autecology, being concerned with the origin and meaning of the tissues and organs of plants, has led to the development of two methods of interpretation. The older, or teleological, may be termed the theory of purpose. It accounts for

the relations between structures and functions, either by special creation or by natural selection having caused specialized structures to arise, obviously adapted for certain ends. The latter modification of the theory may be termed one of *adaptive response*. For example, in very dry soil a very large root system is needed to obtain a sufficient water supply, and the roots are therefore believed to grow longer here because they are needed. Opposed to this view is the newer and more scientific method of interpreting these phenomena on the basis of mechanical causation and fortuitous variation. Plant structures are regarded as the result of responses to definite physical and chemical forces and quite as likely to be harmful or indifferent to the welfare of the plant as to be beneficial. That the latter appear to be more numerous is because plants possessing them are more likely to survive. These variations may also arise fortuitously, or rather as a response to unknown factors, while the factors may be either external or within the plant itself. Probably the correct standpoint is at neither extreme. Structures cannot be built nor functions carried on contrary to chemical or physical laws; but within certain limits there is perhaps room for successful variation, and hence for natural selection and the gradual improvement of structures in relation to plant functions.

Experiments show that some plants are rigid and some plastic. Rigid plants have commonly lived for ages in rigid habitats, as is especially true of desert plants. Plastic plants, on the contrary, often live in variable habitats, the best examples of all plastic plants being the amphibious species. It would seem as if permanence of habitat causes the development of rigid structures, and as if the great plasticity of such amphibious plants as *Ranunculus*, *Nasturtium*, *Polygonum*, *Proserpinaca*, *Sium*, etc., is the result of long life in variable habitats. The desert plant shows the natural selection of advantageous but rigid forms, while the amphibious plant shows the selection of the capacity to vary—a far subtler type of selection. The extreme views of some teleologists, who see a purpose in everything, must certainly be discarded, and it remains for the future to strike a proper balance between mechanical causation, accidental variation, and adaptive response in ecology. For the present, therefore, the ecologist should strive to ascertain the influence of external agents on plant form and should also seek to discover the advantages possessed by certain forms in the performance of the plant functions, but leave the exact relation between form and function to be determined by future investigation.

Physiographic ecology is the most recently developed subdivision of ecology, and deals with the origin and development of plant associations and their relationship to plant communities of a lower and higher order. It has long been evident that groups of associated species are also associated with a definite kind of habitat; e.g., lichens, mosses, and crevice plants are found upon rocks; pond weeds, water lilies, and bulrushes grow in shallow water; beech, maple, beech ferns, and maidenhair ferns thrive together in mesophytic forests. These groups of plants grow together because they thrive in similar conditions. Somewhat later it was also seen that the conditions of a particular habitat did not remain constant, but in the physiographic development of a region the habitats

passed through a series of more or less definite stages, owing chiefly to the processes of erosion and deposition, supplemented by the accumulation of humus, and with these changes of habitat there was a . . . series of changes of the plant . . . , in other words, a definite *succession of vegetation*. Two general lines of succession are seen; for either the primitive associations are upon new land, rocks, or other xerophytic habitats, affording *xerarch successions*, or in the water, giving *hydrarch successions*; but in all regions of mesophytic climate the primitive associations are successively replaced by others slightly more mesophytic, until the series culminates in the most mesophytic association of which the region is capable. For example, this climax association in the northeastern United States, for both xerarch and hydrarch successions, is a deciduous mesophytic forest in which the beech and maple are usually conspicuous trees.

As already stated, the earliest and most useful ecological classification of plants and plant communities was into hydrophytes, mesophytes, xerophytes, and halophytes, or one based upon the water relations of the habitat. Some of the most recent advances in physiographic ecology have been in improved instruments and methods for measuring this water in its relation to plant growth. Plants, as a rule, obtain their water from the soil and lose it into the air. Ecologists therefore measure the amount of water available for absorption by plants above the point where the supply falls so low that they wilt, and at the same time determine the demand for water made upon the aerial parts of the plants by the evaporating power of the air, and the ratio between the two determinations gives, with considerable accuracy the relative moisture of the habitat. More exact methods for measuring the other factors are being sought with some success.

The subject matter of anatomical ecology is not presented as such in this work. The purely morphological aspects are treated under ANATOMY OF PLANTS. Anatomical matter is also presented in connection with the topics HYDROPHYTE; XEROPHYTE; LEAF; ROOT; SYMBIOSIS. Organographic ecology will be treated in connection with the various organs of plants (see LEAF; STEM; ROOT; SEED; POLLINATION; also COLOR; DURATION; VEGETATIVE PROPAGATION) and with various plant forms. (See EPIPHYTE; LIANAS; SAPROPHYTE; SYMBIOSIS.) The topics treated in physiographic ecology, and to some extent in phytogeography, involve organographic material. Synecology will also be treated from the standpoint of topographic habitats (see BEACH PLANTS; BENTHOS; DUNE VEGETATION; HEATH; MEADOW; PLANKTON; ROCK PLANTS; RUDERAL PLANTS) as well as from the standpoint of the water relations (see HYDROPHYTE, MESOPHYTE, XEROPHYTE) and chemical relations of the soil. (See HALOPHYTE.) The ecological aspects of geographic botany are presented under DISTRIBUTION OF PLANTS; ALPINE PLANT; DESERT VEGETATION; FOREST; GRASSLAND; THicket.

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**ECONOMIC ASSOCIATION, AMERICAN** (Lat. *œconomicus*, from Gk. *οικονομικός*, *oikonomikos*, relating to the management of a household, from *οικονομία*, *oikonomia*, management of a household, from *οικος*, *eikos*, house + *νόμος*, *nomos*, law). An organization formed in 1885 and composed mainly of persons interested in the study of political economy or the economic phases of political and social questions. In 1913 it had about 2600 members, made up of teachers of political economy and related subjects, and business men, journalists, lawyers, and politicians interested in the theories of political economy and their application. Its chief feature is its annual meeting, which usually takes place in the last week in December, a convenient city being selected in the East and West in alternate years. The publications of the association include: *Publications of the American Economic Association* (1st series, 1886-97), consisting of reports of annual meetings and of monographs on economic subjects; *Economic Studies* (1896; 1897); *Publications* (2d series, 1897-99; 3d series, 1900-10). From 1908 to 1910 the association published a quarterly *Bulletin*, devoted to bibliography and current notes, and in 1911 established the *American Economic Review*, a quarterly journal holding an important place among the periodicals of economic science.

**ECONOMIC CRISIS.** See CRISIS, ECONOMIC.

**ECONOMICS.** See POLITICAL ECONOMY.

**ECONOMICS, HOME.** See HOME ECONOMICS.

**ECONOMIZERS, or FEED-WATER HEATERS.**

A name given first in England to a device to utilize the heat of the burned or burning gases in the flue or passage between a boiler furnace and its chimney, so as to preheat the feed water which is to be introduced into the boiler. After passing through the boiler flues the furnace gases still retain considerable heat, which ordinarily escapes up the chimney. The economizer is so placed that it receives these gases and extracts a portion of the heat remaining in them. It consists of a series of tubes, made up in sections, connected at the ends and placed in a chamber through which the gases from the boiler pass to the chimney. The feed water is forced through the tubes while the hot gases circulate around them. In most of the best forms of economizer a provision is made to scrape the soot or tarry deposit from the ex-



terior surfaces of the heating tubes. This may be power-driven and work continuously or may be operated by hand and intermittently. The attachment adds enormously to the efficiency of the feed-heating process, as the coating of sticky soot and the flue dust is a nonconductor of heat. Economizers are most effective in securing a saving of fuel in boilers and settings which are so designed that the heating surfaces of the boiler proper do not abstract from the gases and products of combustion as much heat as they might do. Such waste is caught and utilized in the economizer. Provision must be made to prevent excessive pressure from being generated in the economizer and injury from scale and corrosion. The name has also been applied, but less correctly, to a device for preheating the air for combustion in the boiler furnace.

**ECONOMY.** A village in Beaver Co., Pa., 17 miles northwest of Pittsburgh, on the Ohio River and on the Pennsylvania Railroad (Map: Pennsylvania, A 6). It was founded by the "Harmonists" in 1825, after their return from Indiana. Pop. (township), 1900, 1062; 1910, 860. See HARMONISTS.

**ÉCORCHÉ**, â'kôr'shâ' (Fr., flayed). A figure in which the muscles are represented, stripped of the skin, for purposes of art study. From a portion of the figure the upper muscles are also removed so as to exhibit those which lie nearer to the bone. Ancient examples of the subjects survive in the statues of Marsyas flayed by Apollo. Michelangelo is said to have made an écorché of exaggerated dramatic action. The examples most commonly used are those by the sculptor Houdon (q.v.), representing the figure in repose, and by the anatomist Salvage, in which the figure is depicted in violent action, not unlike the Borghese gladiator. Figures of this kind can now be procured both in plaster and papier-maché, and few artists' studios are without them.

**ÉCORCHEURS**, â'kôr'shêr', LES (Fr., the flayers). Lawless bands infesting the rural districts of France and Belgium during the Hundred Years' War. They are first heard of in 1435, when, led by Villandras and Crabannes the Bastard, they began to rob, murder, and strip all unprotected wayfarers.

**ÉCOSSAISE**, â'kô'sâz' (Fr., Scotch). A dance of Scottish origin. It was written in 3-2 or 2-4 time and played upon the bagpipes. The modern *écossaise* is a species of contredanse in quick 2-4 time. Schubert wrote several *écossaises* for the piano.

**ÉCRASEUR**, â'krâ'zêr' (Fr., crusher). A long steel instrument, invented by a French surgeon Chassaignac, and consisting of a fine chain, which, passed round any structure—the pedicle of a tumor, e.g.—gradually constricts it and finally crushes its way through it by means of a screw or rack for tightening the chain, controlled at the end of the handle. A wire may be substituted for the chain. The advantage of this instrument over the knife is that it causes little or no bleeding, the torn vessels spontaneously contracting and closing. The galvanic *écraseur* is even more effective in this respect. This instrument permits the wire loop to be heated to incandescence, thus cauterizing and sealing up blood vessels in its passage through the tissues. It is specially applicable for the removal of polypi and certain tumors.

**ECSTASY** (Lat. *ecstasis*, from Gk. *ἐκστασις*, *ekstasis*, displacement, astonishment, from *ἐξ-στάναι*, *existanai*, to displace, from *ἐκ*, *ek*, out + *ιστάναι*, *istanai*, to stand). A state of consciousness (q.v.) characterized by intense emotional excitement, concentration of attention, and loss of self-control. There are many grades of ecstasy, from overpowering joy or grief to a temporary frenzy closely resembling mania. In the Neoplatonic philosophy of the early Christian centuries, ecstasy denoted a seizure or rapture in which the individual was supposed to transcend the distinction of subjective and objective, to come into direct union with God, and to know the ultimate nature of things. The ecstatic state of mysticism is somewhat similar. It is intended to liberate the soul from the body, to bring inspiration, and to induce the contemplation of supernatural objects. The most common form of ecstasy results from overmastering religious sentiments. Religious ecstasy has appeared from time to time, especially in the Middle Ages, as a widespread epidemic, leading to the most extravagant actions in whole groups of individuals. The term "ecstasy" is also used in mental pathology to denote an abnormal mental condition resembling the catalepsy of deep hypnosis. There are, however, two points of difference. In ecstasy, consciousness is not lacking, the mind being rather dominated by a single idea, and there is subsequent memory of the ecstatic state. Consult Galton, *Inquiries into Human Faculty* (London, 1883). For illustrations, see CONVULSIONARIES; DANCING MANIA; TEBESA, SAINT.

**EC'THESIS** (Neo-Lat., from Gk. *ἐκθεσις*, *ekthesis*, exposition, from *ἐκ*, *ek*, out + *θέσις*, *thesis*, position, from *τίθεμαι*, *tithenai*, to place). The name given to an edict issued by the Emperor Heraclius, in 638, for the purpose of settling the troubles caused by Monothelitism. It confirmed the monothelitic doctrine and failed of its object. It was annulled by Constans II in 648. See MONOTHELITISM.

**ECTHYMA** (Neo-Lat., from Gk. *ἐκθύμα*, *ekthyma*, pustule, from *ἐκθύειν*, *ekthyein*, to break out, from *ἐκ*, *ek*, out + *θύειν*, *thyein*, to rush). A pustular affection of the skin, an eruption, in which yellowish, flat pustules occur which often reach the size of a pea and have a red, slightly elevated, hard base. In the course of 2 or 3 days after the appearance of the pustule, it gains its full size, and after 7 to 10 days it is replaced by a scab, which adheres firmly to the base, and is somewhat concave. On its removal, a deep red mark, a new scab, an ulcer, or a healed scar remains. There is no premonitory or preapular stage. It thus resembles impetigo (q.v.), as well as in being due to pyogenic cocci. It occurs only in debilitated people, especially in cases of chronic alcoholism, cachexia, in delicate and poorly nourished children, etc., and is particularly apt to occur in vagrants and in inmates of jails and almshouses. It also occurs in cases of syphilis, variola, glanders, diabetes, and nephritis. The *Staphylococcus pyogenes aureus*, *albus*, or *citreus* is the causative bacillus. The lesions are inoculable, and may appear when the patient has scratched the bites of fleas, lice, etc. Treatment must be directed to renovating the system with proper food, habits of cleanliness, and general hygiene, bitter tonics, saline and alkaline laxatives, and diuretics. The crusts should be removed with antiseptic washes, and the areas

treated with iodoform, carbolic acid, or bichloride of mercury, resorcin, boric acid, or salicylic acid.

**ECTODERM** (from Gk. *ékros*, *ektos*, outside + *δέμα*, *derma*, skin), or **EPIBLAST**. The outer cellular layer of the embryo. See **EMBRYOLOGY**.

**ECTOPARASITE**. A parasite living upon the surface of its host. Common examples are found among the various mildews growing upon the surfaces of leaves. Branches of these parasitic fungi may pierce the epidermal cells. See **PARASITE**; **PLANT PATHOLOGY**.

**ECTOPLASM**. See **CELL**.

**ECTOR**, or **HECTOR**. 1. The father of Sir Kay and foster father to King Arthur, in the Arthurian legends. 2. The brother of Sir Launcelot, in the Arthurian legend, who, after that knight's death, made an expedition to the Holy Land, where, on Good Friday, he met his death.

**ECTOTROPHIC**. See **MYCORHIZA**.

**ECTOZO'A** (Neo-Lat. nom. pl., from Gk. *ékros*, *ektos*, outside + *ζῷον*, *zōon*, animal). A term in contradistinction to **Entozoa**, designating those parasitic animals which live upon the external parts of other animals, as lice, ticks, etc. Such also are many of the entomostracous crustaceans, parasitic upon fishes, these last being called more particularly **Epizoa**. See **ENTOZOA**.

**ECTROPION** (Neo-Lat., from Gk. *ἐκτρόπιον*, *ektropion*, everted eyelid, from *ék*, *ek*, out + *τρέπω*, *trepein*, to turn). A term applied to eversion of either eyelid exposing a portion of the conjunctiva, the mucous membrane that lines the inner surface of the lids. The lower lid is the more frequently affected. The exposed conjunctiva becomes red and thickened; there is an overflow of tears, causing an irritation and eczematous condition of the skin of the lower lid. Inflammation of the conjunctiva covering the eyeball, and sometimes of the cornea, may result from inability to close the lids. **Ectropion** may be caused by cicatricial contraction after burns and wounds ("cicatricial ectropion"); by paralysis of the facial nerve, causing drooping of the lower lid alone ("paralytic ectropion"); by the relaxation of skin and muscles occurring in old persons and affecting only the lower lid ("senile ectropion"); by spasmodic contraction of the orbicularis muscle ("spasmodic ectropion"); and by long continued inflammation of the eyelid or conjunctiva. Proper bandaging and the application of silver nitrate may cure in some cases; in other cases, operative treatment is necessary. In the cicatricial variety of ectropion, operation is the only effective remedy; in the paralytic form, electricity is generally sufficient.

**ECTYPE** (Lat. *ectypus*, Gk. *ἐκτύπος*, *ektypos*, from *ék*, *ek*, out + *τύπος*, *typos*, figure). In architecture, a cast in relief of an ornamental design, produced from a mold or else an embossed copy of such a design. The term is also applied to a figured copy of an inscription.

**ECUADOR**, *ék'wá-dôr*, *Sp. pron. á'kwá-dôr'* (*Sp.*, Equator, so called because the country is crossed by the equator) (Map: America, South, B 3). A republic of South America, situated on the west coast of the continent and bounded on the north and east by Colombia, on the south by Peru, and on the west by the Pacific Ocean (see accompanying map). The area of Ecuador is about 118,627 square miles; it cannot be stated with accuracy, and there are

pending boundary disputes with Peru and Colombia, the settlement of which has been left to the German Emperor. The Galápagos Islands in the Pacific belong to Ecuador and are included in the above statement.

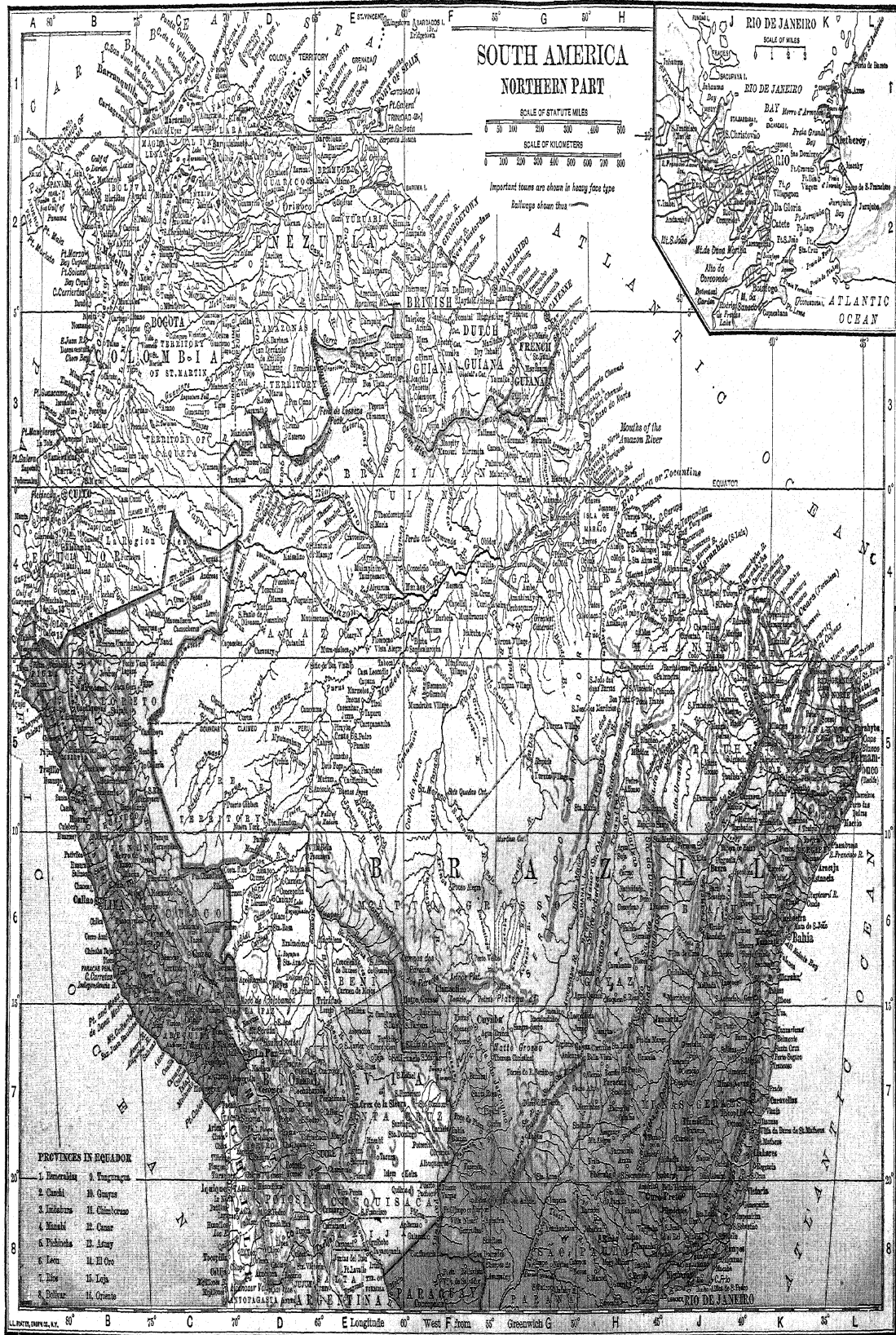
**Topography**. Ecuador may be divided into three physiographic regions: the coast, the Andean highland, and the eastern plains. The coastal region includes a strip of varying width, but averaging about 80 miles between the base of the Andes and the Pacific shores. It is crossed by several small rivers and by mountain spurs of the Andes. The highland region is defined by two parallel ranges or cordilleras connected by a number of mountain knots which divide the plateau between them into 10 basins, and traversing the country in a direction from north to south. (See **ANDES**.) Between the parallel ranges and their connecting ridges lie elevated basins, the centres of agriculture and population, which have an average height of about 8000 feet. East of the Andes the surface falls rapidly to the vast montaña or forests of the Amazonian plains. Ecuador is watered by many streams, which flow either into the Pacific or the Amazon. Those of the latter system are the more important and include the Napo (with its affluents, the Aguatico and Curaray), the longest river of Ecuador; the Putumayo, Pastaza, Morona, and Santiago. Most of them, being interrupted by rapids, are navigable but for short distances. The western rivers are of little consequence. The chief among them are the Mira and Esmeraldas. In the south the Guayas reaches the Gulf of Guayaquil through a long estuary. Lakes are numerous, but mostly small.

**Climate**. Ecuador has naturally a tropical climate, which, however, is considerably modified by the great elevation of the surface. In the low coast regions and the plains of the eastern portion, as well as in the deep river valleys, the climate is hot and rainy, the annual average temperature seldom falling below 80°. To the south of the Gulf of Guayaquil, however, the west coast desert begins. The most salubrious portions of the country are the elevated valleys of the Andes, lying at an altitude varying between 7500 and 9000 feet, where the temperature is moderate and fever almost unknown, and perpetual spring may be said to reign. Owing to their tropical situation, the snow line of the Ecuador mountains is very high, and human habitations are met with at 13,360 feet. Generally speaking, there are two seasons: the rainy season or winter, lasting from December to May, and the dry season, from June to November. Only in the elevated valleys, however, are the seasons marked with distinctive regularity.

**Flora**. The flora of Ecuador does not differ essentially from that of other western countries of South America, and resembles that of Colombia and Peru. In the lower portions, in the east and on the foothills, the vegetation is purely tropical. Thick forests of cabinet woods and of medicinal plants occupy a considerable portion of the territory. Above 6000 feet the vegetation is more northern, while above 10,000 feet trees are seldom met with, and the vegetable life consists of shrubs and coarse grasses.

**Fauna**. The fauna includes the common South American species, such as several varieties of monkey, the jaguar, tapir, llama, vicuña, alpaca,





# SOUTH AMERICA NORTHERN PART

SCALE OF STATUTE MILES

SCALE OF KILOMETERS

Important towns are shown in heavy face type

Railways shown thus



## PROVINCES IN ECUADOR

1. Cachaqui
2. Cachaqui
3. Cachaqui
4. Cachaqui
5. Cachaqui
6. Cachaqui
7. Cachaqui
8. Cachaqui
9. Cachaqui
10. Cachaqui
11. Cachaqui
12. Cachaqui
13. Cachaqui
14. Cachaqui
15. Cachaqui
16. Cachaqui
17. Cachaqui
18. Cachaqui
19. Cachaqui
20. Cachaqui



etc. Birds, which include the condor and a large number of humming birds which are restricted to individual volcanic cones, are represented in numerous species.

**Geology and Mineral Resources.** The Andes contain Archæan gneisses and granites and sedimentary strata of Paleozoic and Mesozoic age, all closely folded and broken in many places by eruptions of volcanic rocks. The coast and the eastern plains are flooded by Cretaceous and Tertiary strata.

Very little has been done to develop the mineral resources of Ecuador, but their value is known to be very great. In the Province of Esmeraldas there are placer deposits of gold along the Santiago, Uimbi, and Cochabibi rivers, which are worked by hydraulic methods, and near Zaruma, Province of Oro, gold quartz is mined by an American company. The export of gold in 1903 was over \$700,000, but in 1910 it was only a little more than \$250,000. Copper, iron, coal, and petroleum are believed to occur in quantities to warrant exploitation. Platinum is found in the Esmeraldas washings, and a small amount of silver is exported.

**Agriculture.** The agricultural resources of Ecuador are considerable. The soil is of singular fertility and produces a large variety of crops. The principal product is cacao, which is cultivated chiefly in the provinces of Manabí, Guayas, and Oro; its production has been steadily rising; the exports of 1911 amounted to 39,500 metric tons and the value of the exports approximately \$9,000,000. Next in importance is coffee, which is cultivated in several districts, the value of the exports being approximately \$700,000 in 1911. The conditions for sugar cultivation are very favorable, and the industry is gradually extending. Tobacco, ivory nuts, rice, Indian corn, as well as the common cereals, such as wheat, barley, oats, and a number of medicinal and industrial plants, are also raised for the home market, as well as for export. The rubber tree abounds, and the collecting of rubber and planting of rubber trees is a growing industry; in 1911 the export of rubber was nearly \$1,000,000 in value. The cattle and sheep holdings are large, and considerable alfalfa is cultivated. Cheese is a staple food.

**Manufactures, Commerce, and Transportation.** With the exception of some coarse fabrics for native consumption, and straw braid used for the manufacturing of Panama hats and other straw articles, Ecuador has hardly any manufactures. The commerce, although steadily increasing, is as yet unimportant. The exports consist chiefly of cacao, vegetable ivory, India rubber, coffee, Panama hats, and rubber. Some gold is also shipped. The exports increased from 14,052,514 sucres (48.7 cents) in 1893 to 26,115,714 in 1911. The imports, consisting mostly of textiles, metal ware, and necessities of life, rose during the same period from 10,052,163 sucres to 23,240,133 sucres. The trade is mostly with France, Germany, Great Britain, and the United States. The commerce with the United States has increased as follows: Imports from Ecuador in 1890, \$836,437; in 1913, \$3,037,689. Exports from the United States in 1890, \$903,159; in 1913, \$2,553,785. The United States imports most of Ecuador's rubber and a considerable portion of its cacao, and exports to it railway supplies and foodstuffs. The chief ports are

Guayaquil, Manta, and Esmeraldas. The mountainous surface of the country is unfavorable to the development of transportation facilities. The roads are mostly for pack animals, being almost impassable during the rainy season. The chief road runs from Quito (q.v.), the capital, towards Guayaquil and the ocean. Of open railway lines Ecuador has only about 500 miles, of which the line from Durán (opposite Guayaquil) to Quito is about 375 miles; this line in 1912 was in operation to within 15 miles of Quito. There is telegraph communication between Quito and Guayaquil, and also with Colombia, while Guayaquil has cable connection with Panama and Peru. The length of the land telegraph lines in 1910 was 3400 miles with 60 telegraph stations. Telephonic systems are in operation in Quito and Guayaquil.

**Government.** The constitution dates from 1830 and has been frequently altered. The present constitution was adopted in December, 1906. The executive authority is shared by the President with a responsible ministry. The President is elected directly for a period of four years. The Congress consists of two houses. The members of the Senate (two for each province) are elected directly for four years. The House of Representatives consists of members elected directly for two years, at the rate of one deputy for every 30,000 inhabitants, with a supplemental deputy for every additional 15,000 inhabitants or more. The Indians, being practically in a condition of slavery, are unrepresented. Congress meets annually, at Quito, on August 10, but can be summoned for an extra session by the President. The voting franchise is restricted to every male citizen of 21 years of age who is able to read and write. The local administrators, from the governors of the provinces down to the lieutenants of the parishes, are all appointed by the President and removed at his discretion. For administrative purposes Ecuador is divided into 16 provinces, besides the Galápagos Archipelago, which is administered by a territorial chief. For the administration of justice there are a supreme court of five judges appointed by the Congress, six superior courts or courts of appeal, whose judges are also appointed by the Congress, and a number of commercial and other inferior courts.

**Army and Navy.** For military defense Ecuador has a standing army of about 3800 men and a national guard about 100,000 strong. The navy consists of a torpedo boat and a transport. For National Coat of Arms, see Colored Plate in article HERALDRY. For National Colors, see Colored Plate of FLAGS.

**Finance.** The revenue of Ecuador is derived mostly from customs duties (about 70 per cent from this source) and to some extent from taxes on real estate and from government monopolies and property. The budget for 1913 estimated the revenue at a sum equivalent to \$9,921,000 in United States currency, and the expenditure at a like sum. Ecuador's share of indebtedness at the dissolution of the Republic of Colombia in 1830 amounted to £1,824,000 (\$8,883,000). In 1854 the bondholders finally secured from Ecuador a formal recognition of its debt. In 1867 payment on the debt ceased, and the arrears amounted in 1891 to £428,640. By an arrangement with the creditors in 1892 the principal was reduced to £750,000, which sum was afterward further reduced. In 1904 the entire foreign debt amounted to 8,566,000 sucres, held



entirely by the Guayaquil and Quito Railway Company. In 1911 a new loan of 3,000,000 sucres was contracted with Speyer & Co., of New York. The total indebtedness was stated in 1914 at 40,625,000 sucres, equivalent to \$19,780,000 in United States currency. Ecuador adopted the gold standard in 1900. The silver coinage has been almost entirely superseded by gold. The circulation in 1910 was: gold, 5,087,000 sucres; silver, 2,783,000; paper, 9,835,000. The Banco del Ecuador and the Banco Comercial y Agrícola, with a combined capital of 8,000,000 sucres, issue notes for circulation, which amount now to about 10,000,000 sucres. There are two other leading banks.

**Weights and Measures.** The Law of 1898 established the gold standard with a gold coin, the *condor*, containing 7.3224 grams of fine gold and equivalent in value to the English pound sterling; the silver *sucre*, one-tenth of the value of the condor and the designated unit of value (value, 48.7 cents in United States currency); and nickel and copper coins, fractions of the sucre. The metrical system, adopted in 1856, is used only in official publications. The current measures and weights are essentially the same as in the United States. The unit for linear measure is the *vara* (yard); for weight, *libra* (pound); for capacity, *fanega* (4.44 cubic feet).

**Education.** Elementary education is gratuitous and obligatory. There are a university at Quito and a number of secondary schools; the elementary schools number over 1000 and have an attendance of about 70,000. Education is at a low ebb.

**Population.** The population (official estimate in 1900) by provinces is given as follows:

Carchi .....	40,000	Bolivar .....	43,000
Imbabura .....	68,000	Los Rios .....	32,800
Pichincha .....	205,000	Oro .....	32,600
Leon .....	109,600	Guayas .....	98,042
Tungurahua .....	103,033	Manabi .....	64,123
Chimborazo .....	122,200	Esmeraldas .....	14,600
Cañar .....	64,014	Oriente .....	80,000
Azuay .....	132,400	Galapagos Islands	2,000
Loja .....	66,000		

Total.....1,277,800

In 1910 the population was estimated at 1,500,000. The population of the territory of the Galapagos is given as 400. Principal cities: Quito, 70,000; Guayaquil, 80,000; Cuenca, 30,000 (these being estimates for 1910). The whites number about 100,000; those of mixed origin about 400,000; while the remainder consists of Indians and a small number of negroes. The prevailing language of Ecuador is a Peruvian dialect. There are said still to be communities of pure Quichuas. The Cayapas and the Tochi are probably descended from the ancient conquered peoples of Ecuador. The civilized Indians, belonging generally to the Quitus race, form the great laboring class. In the Amazonian valleys several tribes—the Oregones, Encabell dos, etc.—are related to those of western Brazil. In the east, too, generally are found the Jivaros, Zaparo, Abiquira, and other peoples who are supposed to be of the Tupi and the Carib races. They were formerly progressive and prosperous, but have greatly deteriorated since the expulsion of the Jesuits in the latter part of the eighteenth century.

**History.** The history of Ecuador up to the coming of the Spaniards is involved in obscurity. Whatever there was among the natives

in the way of writings and records which dealt with their earlier experiences the fanatical missionaries converted into ashes. There is, however, among the Indians the tradition that centuries prior to the coming of the Europeans there had existed a strong kingdom in what is now Ecuador, called Quito, which in the tenth century was overthrown by a coast people known as the Caras. The kings of the Caras occupied the throne until 1475, when, after a long and desperate resistance, they succumbed to the Inca armies of Peru, led by Huayna Capac the Great, who added Ecuador to his dominions, establishing his capital at Quito. At his death his territories were divided between his two sons, Huascar, who held Peru, and Atahualpa, who reigned at Quito. They soon fell out, prosecuting war after war against each other, the former being at last overthrown in 1532. It was at this junction that Pizarro, having with a handful of men embarked upon the conquest of the realm of the Incas, arrived on the scene. He seized Atahualpa at Cajamarca, and in 1533 he put him to death. The vast territories of the unfortunate Inca were added to the Spanish Empire. They were erected into a presidency, with Quito as capital, and subordinate to the Viceroy of Peru. It remained thus until the outbreak of the great revolution which freed South America from Spanish rule.

The defeat of the Spaniards in the battle of Pichincha in 1822 liberated the Province of Quito, which joined New Granada and Venezuela in forming the Republic of Colombia, organized under the auspices of Bolívar. In 1829 Venezuela withdrew from the confederation, and in 1830 the independent Republic of Ecuador was constituted. Then there followed a number of struggles between rival political leaders, of whom the chief were Flores and Rocafuerte, which demoralized the country, destroying all security of person and fortunes. The Ecuadorians, however, were not content with fighting among themselves; they interspersed their local outbreaks with wars against their neighbors, Peru and Colombia. In 1845 Vicente Roca became President, and one of the principal acts of his régime was the convention for the abolition of slavery.

From 1850 the struggle between the Clerical and Liberal parties became bitter. In that year Diego Noboa, of the Clerical party, having seized the presidency, was overthrown by the Liberals under General Urbina. The power rested with the latter party till 1860, when there occurred a general breaking up, with several leaders claiming the presidency. The Clericals finally triumphed, electing Dr. Garcia-Moreno, who became distrusted before the end of his term. Forcing his own election a second time in 1869, he endeavored to establish a religious despotism, but was assassinated in 1875. Numerous revolutions took place during the next twenty years, and in 1895-96 a new civil war broke out between the two parties, resulting in a Liberal triumph. The Liberal leader, General Eloy Alfaro, assumed dictatorial powers, and was elected to the presidency in 1897. He pursued an active anti-Clerical policy, and his term was disturbed by various Clerical uprisings, one of which caused troubles with Colombia (1899). In 1901 General Leonidas Plaza, the administration candidate, was elected to the presidency and quietly assumed office (August 31). His anti-Clerical

policy continued that of his predecessor; civil marriage and divorce were introduced, and in 1904 all religions were made equal before the law. The establishing of new monasteries and convents was forbidden in the interest of the economic conditions of the country, and all church property was finally declared to be the property of the nation. In 1905 the Clericals were successful in electing to the presidency Lizardo García, a wealthy merchant, who was overthrown in January, 1906, by an uprising led by ex-President Alfaro, who was declared supreme dictator by the army. In 1911 Alfaro secured the election of his candidate, Emilio Estrada, who was unpopular, but who assumed the presidency after a popular tumult, marked by the assassination of a number of leaders, which secured the written abdication of Alfaro. The death of Estrada again plunged the country into revolution. General Plaza took charge of affairs and General Montero issued a *pronunciamiento* against the government (December, 1911). About 1000 revolutionists were slaughtered at Guayaquil by a strategy of Plaza, after which the British and United States consuls intervened and arranged a capitulation. This was violated before completion and General Montero was shot, while Alfaro, who had joined the revolutionists, and a number of other leaders were taken from prison and assassinated by a mob at Quito. General Plaza, the provisional head of the government, was again elected constitutional president in 1912. He took steps to reestablish the credit of the country and in 1913 signed a contract for cleaning up Guayaquil (q.v.). Late in this latter year new revolts took place and continued in 1914, considerable fighting taking place at Esmeraldas, which was alternately in the hands of the rebel and the government forces. The present good condition of Ecuadorian finances is largely due to the initiative and ability of the American railway builder and financier, Mr. Archer Harman, who has taken a deep interest in Ecuador's welfare.

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**ECUMENICAL COUNCIL.** See COUNCIL.

**ECZEMA** (Neo-Lat., from Gk. *ἐκζεμα*, *ekzema*,

skin disease, from *ἐκζειν*, *ekzein*, to boil out, from *ἐκ*, *ek*, out + *ζειν*, *zein*, to boil). An inflammatory disease of the skin characterized by a number of cutaneous lesions, such as macules, papules, pustules, vesicles, scales, and crusts, generally with exudation of serum and intense itching. It is the commonest skin disease and represents from one-half to one-third of all cutaneous affections. It may be acute or chronic in its course. It is divided into four elementary types—erythematous, papular, vesicular, and pustular; but there are several secondary types, such as squamosum, rubrum, parasiticum, seborrhœic, . . . . . neuroticum, diabeticum, . . . . . verrucosum, and sclerosum. Among internal causes of eczema are alcoholic beverages, dietetic errors, medicines, visceral disorders, gout, scrofula, and neurasthenia. From the belief that a "humor of the blood" caused eczema, it has been commonly called "salt rheum." Among external causes are scratching, heat, cold, friction, and pressure, acids and poisons, and animal and vegetable parasites. Treatment must be directed to the particular form of the disease. In all cases strict dietetic and hygienic rules must be followed; causes must be removed or treated with a view to removal; laxatives, iron tonics, bitter principles, and electricity are used. Locally, antiseptic powders, zinc, salicylic acid, permanganate of potash, tar, ichthyol, thymol, oil of cade, bismuth, mercury, lead, carbolic acid, sulphur, and green soap are among the drugs used. Each case must be intelligently studied if treatment is to succeed.

**EDAM**, Dutch pron. à-dām'. A town of the Netherlands in the Province of North Holland, near the Zuyder Zee, 12 miles north-northeast of Amsterdam (Map: Netherlands, D 2). Its Reformed church of St. Nicholas, with large painted windows, is among the finest in North Holland. The town is chiefly known through its cheeses and its cheese fair. Other industries are shipbuilding, leather manufacture, rope and sail making. Pop., 1900, 6444; 1910, 6623.

**EDAM CHEESE.** See CHEESE; CHEESE MAKING.

**EDAPHIC** (from Gk. *ἐδαφος*, *edaphos*, foundation, soil). In botany the term is used with reference to local influences, especially those that reside in the soil, that affect the growth and distribution of plants. The soil itself exerts such influences through (1) its chemical composition and (2) its physical nature. The latter is probably the more important, for the size of the soil particles and their looseness or compactness determine the amount of water the soil will absorb and retain. The former seems of importance only where certain salts are present in excess, as in alkaline depressions, salt marshes, or where acids are particularly abundant, as in certain types of swamps. The amount of humus in a soil is important in changing both the chemical and the physical nature of the soil.

Edaphic influences, being local, are contrasted with climatic, which are widespread; e.g., a cypress swamp is an edaphic, and a desert is a climatic, area. See ECOLOGY; DISTRIBUTION OF PLANTS.

**EDDA**. A title applied to two distinct works in Scandinavian literature, the *Edda* ascribed to Sæmund the Wise and the *Edda* of Snorri Sturluson. They are also called respectively the Poetical and the Prose, and the Elder and

the Younger Edda. The latter of these, to which alone the name Edda is properly applied, treats of Scandinavian mythology and of the language and modes of composition of the ancient skalds (q.v.). Its original purpose was to serve as a guide for young poets. Accompanying this Edda are four grammatical treatises, which are frequently included in modern editions. They have also been published separately, with critical introductions and notes (Copenhagen, 1884-86). As its second name implies, the Prose Edda is ascribed to the Norse historian and politician Snorri Sturluson (q.v.), who flourished in the first half of the thirteenth century. Originally it consisted of three main parts: (1) *Gylfaginning* (the deception of Gylfi), in which various exploits of the gods and goddesses are related to a mythical Swedish king Gylfi, who is supposed to visit Asgard; (2) *Skáldskaparmál* (the language of poetry), in which an explanation is given of many of the figures of speech used by the skalds; (3) *Háttatal* (list of metres), a catalogue of the different kinds of metres used by the skalds. Snorri's treatment of the mythology is often inaccurate and is not free from contradictions. This is, however, in spite of its evident faults, one of the most important monuments of Old Norse literature. The Prose Edda was first published by Resenius in Copenhagen in 1665. This edition includes a translation into Latin by the editor and others. The next edition was published in Sweden (1746). The first modern critical edition is that of Rask, published at Stockholm in 1817. The most complete modern edition is the Arna-Magnæan (Copenhagen, 1848-87), in 3 vols., with a Latin translation and notes. Finnur Jónsson has edited both the Eddas, with German notes (1880-90). E. Wilken's *Die Prosaische Edda in Auszuge* (1877-82) contains the first two parts, with a German glossary. The standard German translation is Simrock's (1851). The *Gylfaginning* was translated into French by Bergmann (2d ed., 1871). The mythological part has been translated into English by Dasent (1842) and by Blackwell (in Mallet's *Northern Antiquities*). R. B. Anderson's version (1880) includes the narrative portion of the *Poetical Diction* and several minor parts.

The Elder Edda is a collection of mythological and heroic Scandinavian songs, 33 in all, the date of whose composition in their present form may probably be referred to different periods between the tenth and the thirteenth centuries. The view that assigns to them a great antiquity is no longer held by scholars. The arrangement of the whole is very unsystematic, and the text is in many parts corrupt. Vigfússon, in the *Corpus Poeticum Boreale*, vol. i (1883), tried to rearrange the parts, but his attempt is regarded as ingenious rather than convincing. These songs, which were discovered and first brought to the notice of European scholars in 1643 by Brynjólfur Sveinsson, Bishop of Skálholt, in Iceland, were incorrectly supposed by him to be the work of Sæmund the Wise (1055-1132). His application to them of the name Edda is also improper, as that title, which probably means "poetic guide," belongs only to the prose work. The etymology of the word that connects it with "great-grandmother" is no longer taken seriously. The unique manuscript in which the Elder Edda is contained is called the *Codex Regius* and is lodged in the Royal Library at Copenhagen. A splendid litho-

graphic facsimile edition, with a diplomatic text, was issued in 1891 under the editorship of Wimmer and Jónsson. A facsimile of a fragment of another manuscript of the Edda was published five years later by Jónsson. The collection was first published entire at Stockholm in 1818 by A. A. Afzelius, and at Copenhagen by the Arna-Magnæan Commission in 1777-1828, with a Latin translation, glossaries, etc. Complete editions were also published by Munch (1847), Luning (1859), Möbius (1860), and Svend Grundtvig (1867). But all former editions have been superseded by that of Sophus Bugge (1867). Hildebrand's edition (1876) is accompanied by a valuable glossary by H. Gering (2 ed., 1896). Consult also: Detter and Heinzel, *Saemundar Edda* (2 vols., Leipzig, 1903); Sijmons and Gering, *Die Lieder der Edda* (2 vols., Halle, 1903-06), and Gering, *Vollständiges Wörterbuch zu den Liedern der Edda* (Halle, 1903), containing both text and vocabulary; Genzmer, *Edda, übertragen, mit Einleitungen und Anmerkungen, von A. Heusler* (Jena, 1912). In German the best rendering is Simrock's. Both Ettmüller and the brothers Grimm have translated portions. The latest German versions are due to Gering (3d ed., 1912) and Genzmer (1912). A Danish rendering of the mythical lays by Karl Gjellerup was issued in an illustrated edition in 1895. The standard Danish translation is Müller's (1871). There is a French rendering by E. de Laveleye (1866). The earliest English translation is Cottle's (1767). A complete English translation by Ben Thorpe was published in 1866; another translation was begun by Collingwood (London, 1908). Several of the lays are translated by R. B. Anderson in his *Northern Mythology* (1875). In the *Corpus Poeticum* an English rendering is given by F. Yorke Powell, in which the arrangement of Vigfússon's text is followed.

For a discussion of the question of the possible non-Scandinavian origin of the Elder Edda, consult Bugge, *Home of the Eddic Lays*, trans. by Schofield (London, 1899). For a general account in English of the scope of the Edda, consult W. Faraday, *The Edda* (London, 1902). For a comparative study of the language and grammatical forms, consult Noreen, *Geschichte der nordischen Sprachen besonders in altnordischer Zeit* (3d ed., Strassburg, 1913). See also SCANDINAVIAN AND TEUTONIC MYTHOLOGY.

ED'DOES. See COCCO.

EDDY, CLARENCE (1851- ). An American organist and composer, born at Greenfield, Mass. He studied under Dudley Buck in Hartford, counterpoint under Haupt, and piano under Loeschhorn in Berlin. In 1894 he was made organist of the First Congregational Church in Chicago, where he also was director of the Hershey School of Musical Art from 1875 to 1908. In 1908 he took up his residence in New York. Mr. Eddy's series of 100 organ recitals, with entirely different programmes, given in 1877-79, is one of the most memorable achievements in the history of American music. He composed organ music, translated Haupt's *Counterpoint, Fugue, and Double Counterpoint* (1876), and published *The Church and Concert Organist* (1882-85), *The Organ in Church* (1887), etc.

EDDY, HENRY TURNER (1844- ). An American scientist, born at Stoughton, Mass. He was educated at Yale University and Sheffield Scientific School and later took a further

scientific course in Berlin and Paris. After holding a professorship in mathematics, astronomy, and civil engineering at the University of Cincinnati (1874-90), and acting as dean of the academic faculty of that institution (1874-77, 1884-89), he became its president in 1890. He was also president of the Rose Polytechnic Institute at Terre Haute, Ind., from 1891 to 1894, when he accepted the chair of engineering and mechanics at the University of Minnesota. He became dean of the Graduate School of the latter university in 1906. His works include: *Analytical Geometry* (1874); *Researches in Graphical Statics* (1878); *Thermodynamics* (1879); *Neue Constructionen aus der graphischen Statik* (1880); *Maximum Stresses under Concentrated Loads* (1890); *Theory of the Flexure and Strength of Rectangular Flat Plates Applied to Reinforced Concrete Floor Slabs* (1913).

**EDDY, MARY BAKER** (c.1821-1910). The founder of Christian Science. She was born at Bow, near Concord, N. H. In 1843 she married Col. George W. Glover of Charleston, S. C., where she resided until his death. From that time Mrs. Eddy made her home in New Hampshire and Massachusetts. In 1877 she married Dr. Asa G. Eddy. Mrs. Eddy gives 1866 as the date when she discovered what she afterward presented to the world as the science of Christianity. She founded the First Church of Christ, Scientist (the "Mother Church"), in Boston in 1879 and opened the Massachusetts Metaphysical College there in 1881. She is most widely known as the author of *Science and Health with Key to the Scriptures*. The first edition of this work was published in 1875, and since then it has been often reprinted, with occasional revisions of its wording before her decease. It sets forth the Christian Science interpretation of the Holy Scriptures and this method of healing. Mrs. Eddy's followers believe that living in strict accord with Christian Science will not only improve their moral and spiritual condition, but will insure physical welfare. Mrs. Eddy's other publications are: *People's Idea of God* (1886); *Christian Healing* (1886); *Retrospection and Introspection* (1891); *Unity of Good* (1891); *Rudimentary Divine Science* (1891); *No and Yes* (1891); *Church Manual* (1895); *Miscellaneous Writings* (1896); *Christ and Christmas* (1897); *Christian Science versus Pantheism* (1898); *Pulpit and Press* (1898); *Messages to the Mother Church* (1900; 1901; 1902); *The First Church of Christ, Scientist, and Miscellany* (1913). Mrs. Eddy died Dec. 3, 1910, at Newton, Mass., leaving the bulk of her estate to be used for extending the world's knowledge of the religion which she taught. Consult *Life* by Wilbur (4th ed., Boston, 1913). See **CHRISTIAN SCIENCE**.

**EDDY, RICHARD** (1828-1906). An American Universalist clergyman, born at Providence, R. I. During the Civil War he was chaplain of the Sixtieth New York Volunteers, and of this regiment he wrote a history. After 1877 he was president of the Universalist Historical Society and after 1887 editor of the *Universalist Register*. He published: *History of Universalism in America, 1636-1886* (1884-86); *Alcohol in History* (1887); *Universalism in Gloucester, Mass.* (1892); *History of Universalism, 120-1890, A.D.* (1894); *Life of Thomas J. Sawyer, D.D., and Caroline M. Sawyer* (1900). He was a

contributor to the first edition of the *New International Encyclopedia*.

**EDDY, THOMAS MEARS** (1823-74). An American clergyman, born in Newton, Hamilton Co., Ohio. He entered the Methodist ministry, joining the Indiana conference in 1842. For a term he was pastor at Jeffersonville, where he became intensely interested in prison reform. In 1854 he was agent for the American Bible Society. He was editor of the *North-western Christian Advocate* from 1856 to 1868. In 1872 he became one of the missionary secretaries of his denomination. In the meantime he held important pastorates in Baltimore and Washington. D. C. Consult *The Life of Thomas M. Eddy, D.D.*, by Charles N. Sims (New York, 1880).

**EDDY, WILLIAM ABNER** (1858-1909). An American meteorologist, born in New York. He took a preparatory course at the University of Chicago. Beginning experiments in kite flying in 1890, he gave special attention to problems of air currents and air layers, and in 1896 he first took pictures of the earth by controlling a camera attached to one of his kites, some of which attained a height of nearly 7000 feet. In 1903 he came to the conclusion, from the actions of an aeroplane model which he had released from a large flying kite, that eventually the aeroplane would be a practicable means of travel. He also investigated the relation of high-air temperature to that on the earth and constructed various devices to measure earth tremors.

**EDDY CURRENTS.** See **FOUCAULT CURRENTS**.

**ED/DYSTONE.** See **LIGHTHOUSE**.

**EDELFELO, a'del-felt, ALBERT GUSTAV ARISTED** (1854-1905). A Finnish portrait, landscape, and genre painter, born at Helsingfors. He studied at the Academy of Fine Arts in Antwerp and then under Gérôme in Paris, where he lived many years. He first attracted attention with a portrait, "Pasteur in his Laboratory," but is at his best in studies of the life and scenery in his native country, painted with the freshness of vision of the North combined with a strong sense of the pictorial learned from the French. Among the best are: "Divine Service on the Seashore" (1882, Luxembourg Museum); "The Women in the Churchyard"; "Christ and the Magdalen," treated as a Finnish legend (both in Helsingfors Museum); and the "Laundry," which made a sensation in Munich in 1893. Edelfelt was very versatile and is also known as a water-color and pastel artist. He received a first-class medal in Paris in 1889 and was made Commander of the Legion of Honor in 1901.

**EDELMANN, a'del-mán, JOHANN CHRISTIAN** (1698-1767). A German rationalist, born at Weissenfels. He studied theology at the University of Jena, resided for a time with Count Zinzendorf at Herrnhut, and participated in the translation of the Berleburg Bible. Soon after he turned weaver, donned a Mennonist smock frock, and continued authorship only at the request and with the support of interested friends. Having come to Neuwied, he was there compelled by the Count to draw up a confession of faith; and when this was printed, without his consent and in a garbled version, he retorted by publishing the true copy with annotations as an *Abgenötigtes, jedoch andern nicht wieder aufgenötigtes Glaubensbekenntnis* (1746). Perse-

cuted as a freethinker, he fled to Altona, where he lived in concealment, not venturing into Hamburg by day for fear of the derision of the workmen from the cordage factories. In 1749 he went to Berlin, where Frederick II, though forbidding him to publish further, tolerated him, on the ground, it is said, that fools had to be endured. He was described as a choleric and laborious person. He was among the first German opponents of positive religion, which he denounced as superstition. His views were not new, but were proclaimed with a blasphemous emphasis which attracted brief attention. Among his other works are: *Moses mit aufgedecktem Angesicht* (1740); *Christus und Belial* (1741); *Die Gottlichkeit der Vernunft* (1742). His last work, edited by Klose, appeared in 1811.

**EDELWEISS**, a'del-vis (Ger., noble white, from *edel*, noble + *weiss*, white), *Leontopodium alpinum*. An Alpine perennial woolly plant of the Composite family, found in Switzerland, the Tirol, Carinthia, Alpine Austria, and Siberia. It bears heads of flowers surrounded by woolly bracts and sage-green leaves. It is famous, not for its beauty, but because of its scarcity and the difficulty of obtaining it in its elevated haunts, and is so rare in Switzerland that several cantons protect it by law. It is readily cultivated in gardens in America and Europe. In Swiss poetry and legend it plays a prominent part.

**EDEMA**. See **CEDEMA**.

**EDEN** (Heb. 'eden, delight). According to the biblical account, the first residence of man. On the supposition that the narrative in Genesis describes a real country, endless views have been brought forward in regard to the situation of Eden. In Ethiopic Enoch xxxii, 3, the "garden of righteousness" is placed in the northeast far beyond the Erythraean Sea. Josephus and several of the fathers conceived of the river of Eden as the earth-encircling ocean and looked for Eden itself somewhere between the Ganges and the Nile. Calvin, Huet, Bochart, and others have, with slight differences of detail, decided in favor of southern Babylonia, not far from the Persian Gulf; Reland, Calmet, Hales, Bunsen, Keil, in favor of Armenia, near the sources of the Tigris and Euphrates; and Le Clerc, in favor of the region near Damascus, while even Australia and the North Pole have been advocated. The description in Genesis (chap. ii) seems to assume the existence of a great river which forms the source of larger streams. The writer mentions four such streams—the Tigris, Euphrates, Gihon, and Pishon. The first two are well known, but it is not clear what he meant by the latter two. It has been supposed that he intended the Gihon for the Nile, as Josephus already has it (*Ant.* i, 1-3), and if it be recalled that many centuries later Arabic geographers supposed the Nile to have its rise in India, it would not perhaps be strange that the source of the Nile should have been unknown to this earlier writer. But it is by no means certain that he meant the Nile. For the Pishon, which "encompasses" the land of Havilah, some part of Arabia, the Arabian Sea has been suggested; and since the Persian Gulf is in cuneiform inscriptions called a river, it is not improbable that a writer who had only heard of southern Arabia should call the body of water flowing around it a river. Glaser and others have maintained that Pishon is the Arabian Wadi Faisan. The Karun has been claimed for

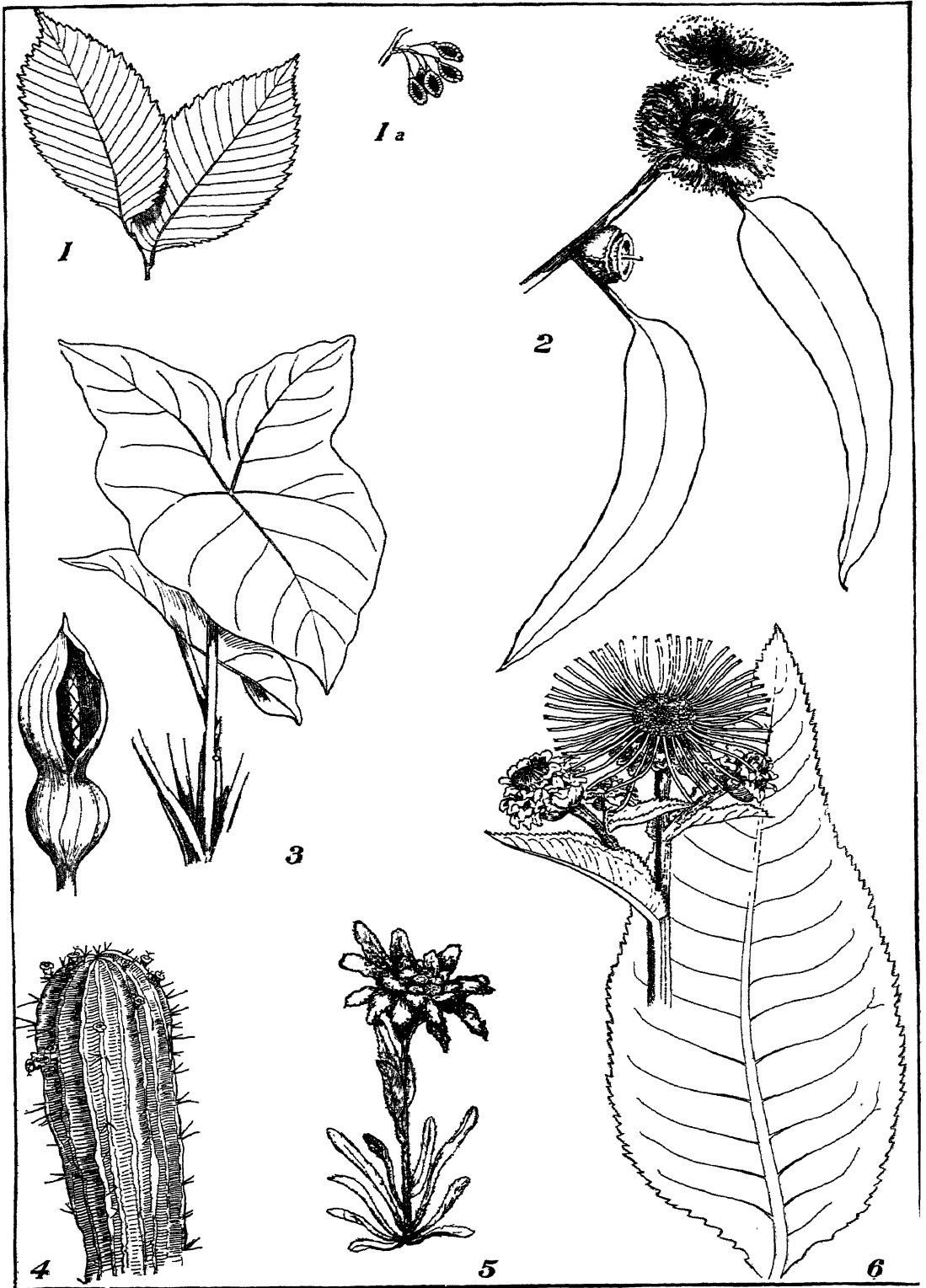
Gihon on the ground that Cush is probably a wrong pronunciation for Kash, the country whence the Kassites came. However that may be, the original habitat of man for the biblical writer is likely to have been in the same region in which mankind dwelt before the dispersion. It has been supposed that Edinn was the Sumerian name of the plain of Babylon, but this is doubtful, though the identification of Eden with Edinn may be admitted. A connection has also been assumed between Eden and Beth Eden (Amos i. 5), the Eden of Ezek. xxvii. 23, and the "Sons of Eden" of 2 Kings xix. 12. But in all of these passages it is probable that the Bit Adini of the Assyrian inscriptions is meant (see ASSYRIA), which can scarcely have had any relation to the Eden of Gen. ii. Of the vast literature on Eden, but little is of value at present. It will be sufficient to refer to Delitzsch's work *Wo lag das Paradies?* (1881), although his theory of the identification of Gihon and Pishon with two of the canals of Babylonia is not tenable. Consult also the commentaries on Genesis by Dillmann, Holzinger, Strack, Driver, and more particularly that of Gunkel (3d ed., 1910).

**EDEN**. A town in Hancock Co., Me., 35 miles (direct) southeast of Bangor, on the Maine Central Railroad, the Atlantic Ocean, and on the line of the Eastern Steamship Company (Map: Maine, D 4). Eden is situated on Mount Desert (q.v.) Island and it contains the village of Bar Harbor, the well-known summer resort. There are a hospital, public library, and a Federal building. Pop., 1900, 4379; 1910, 4441.

**EDEN, GEORGE**. See **AUCKLAND, GEORGE EDEN, EARL OF**.

**EDEN, SIR ROBERT** (1741-84). An English baronet, the last proprietary Governor of Maryland. He was the second son of Robert Eden, of Winderstone Hall, Durham. Before he was 16, he obtained a commission in the Royal Regiment of Artillery; in 1758 he was raised from cadet to ensign in the Coldstream Guards, and in 1762 he was promoted captain. He served in Germany during the Seven Years' War and soon after returning to England married the sister of Frederick, the sixth and last Lord Baltimore. His appointment as Governor of Maryland in 1768 was due to his family connection; but after his arrival in June, 1769, he displayed tact and ability in the stormy times which he came upon and endeared himself to the people by his prudence and kindness. The most serious controversy in which he held out against the people was that over the fees of public officers. In a proclamation of Nov. 24, 1770, he asserted that it was his prerogative to settle such fees, and although he maintained his position until the institution of the provisional government, the colonists blamed only his advisers without becoming embittered against him. The death of Lord Baltimore in September, 1771, undermined the proprietary government, for the loyalty of the colonists did not extend to the illegitimate son, Henry Harford, who became the next proprietary, and during the absence of their Governor, who went home to act as an executor of his brother-in-law's estate, great advances were made towards independence. He remained in the Colony until June 23, 1776, when, Congress having ordered his arrest for his correspondence with British officers, and Maryland having definitely committed herself to the principles of the Revolution

EDELWEISS, ETC.



1. ELM LEAF (*Ulmus Americana*).

1a. FRUIT, of the same Elm.

2. BLUE GUM SPRAY (*Eucalyptus globulus*).

3. CALADIUM or ELEPHANT'S EAR (*Caladium bicolor*) and spathe.

4. AN AFRICAN EUPHORBIA (*Euphorbia officinarum*).

5. EDELWEISS (*Leontopodium Alpinum*).

6. ELECCAMPANE (*Inula helonium*).





and having virtually declared the proprietary government at an end, he escaped on a British war vessel. Shortly after his arrival in England he was created a baronet. During his term as Governor he had assumed the rôle of apologist for the Colony and had believed in its loyalty to the end. He returned to Maryland in 1784 on business, and died in Annapolis, on September 2 of that year. Consult Steiner, "Life and Administration of Sir Robert Eden," in the *Johns Hopkins University Studies in Historical and Political Science*, 16th series, nos. vii-ix (Baltimore, 1898).

**EDEN, WILLIAM.** See **AUCKLAND, BARON.**

**EDEN HALL, LUCK OF.** See **LUCK OF EDEN HALL.**

**EDENTATA**, or **BRUTA** (Lat. nom. pl., toothless, from *e*, out + *dens*, tooth). An order of Mammalia, established by Cuvier, who remarked that, although brought together by a purely negative character, the Edentata have, nevertheless, some positive mutual relations, particularly in the great claws which approximate to the nature of hoofs; also in a certain slowness or want of agility, obviously arising from the peculiar organization of their limbs. He included among them, however, the monotremes, now entirely separated. The anteaters and pangolins are the only Edentata that are absolutely destitute of teeth; but none of the order have any teeth in the fore part of their jaws, and their teeth are comparatively imperfect in structure, being destitute of enamel and distinct roots; they grow from a distinct pulp, are all alike, and (except in Tatu) are not preceded by a set of milk teeth. The sloths alone subsist on vegetable food, the rest chiefly on insects or on animal substances in a decaying state. The Edentata form one of the smallest orders of mammals; its headquarters are in South America, but some species are found in Africa and southern Asia. All are clothed with coarse hair, which in the sloths and anteaters completely covers the body, in the pangolins is united into overlapping plates or scales, and in the armadillos is very sparsely scattered over the body, which is otherwise protected by dermal plates. The Edentata are generally ranked as the lowest of the placental mammals, not merely because of the condition of the teeth, but because the brain is small and poorly developed, the cerebrum not nearly covering the cerebellum and being perfectly smooth. The order is generally grouped in five tribes or suborders: the sloths (*Tardigrada*), which are characteristic of South America; the pangolins (*Squamata*), found only in Asia and Africa; the armadillos (*Loricata*), found from Texas southward in America; the true anteaters (*Vermilinguia*), found only in South America; and the aard-varks (*Fodientia*), found only in Africa. No living Edentata are known in Europe. Consult: Rapp, *Anatomie Untersuchungen über die Edentata* (2d ed., Berlin, 1852); Flower, "Mutual Affinities of the Edentata," in *Proceedings Zoölogical Society of London* (London, 1882); Thomas, "A Milk Dentition in *Orycteropus*," in *Proceedings Royal Society of London*, vol. xlvii (ib., 1890); Klinckowström, *Zur Anatomie der Edentaten* (Jena, 1895); Windle, "Myology of the Edentata," in *Proceedings Zoölogical Society of London* (London, 1899); Beddard, *Mammalia* (ib., 1902); also authorities referred to under the various groups, as **SLOTH**, ETC. See Plate of **ANTEATERS**.

**Fossil Edentata.** Remains of fossil edentates have been found rarely in the Tertiaries of Europe and Africa. The centre of greatest development seems to have been South America, during ancient times as well as at present, though some imperfectly known forms, more nearly like the normal mammals in dentition, having incisor teeth on both jaws and the normal premolar and molar teeth, have been discovered in the Eocene deposits of North America. The paleontologic evidence does not support the hypothesis that the edentates represent primitive forms of mammals, but it does show that they have been derived by regressive evolution from higher normal eutherian types, and that they constitute a degenerate series of mammals, the exact origin of which is, however, unknown. See **DEGENERATION AS A FACTOR IN EVOLUTION**; **EXTINCTION OF SPECIES**.

No fossil form of the sloths (family *Bradypodidae*) or anteaters (*Myrmecophagidae*) has been found, but an extinct form (*Myrmecophaga riidæ*) presents characters intermediate between these two modern groups. They were mostly mammals of gigantic size, such as *Megatherium*, *Mylodon* (qq.v.), *Scelidotherium*, and *Megalonyx*, the remains of which are found commonly in the Pleistocene deposits of South America, and occasionally in the Pleistocene cave deposits of North America, as far north as Kentucky. The armored edentates, such as the armadillos and glyptodonts, are connected with the megatheriums through *Megalonyx*, which has ossified plates imbedded in its skin. These isolated plates became united into transverse rows in the armadillos and into a solid carapace in the glyptodonts. The gigantic glyptodon (q.v.) and the allied *Doedicurus*, from the Pleistocene beds of Argentina, have the body inclosed in a solid massive carapace made of polygonal bony plates that are firmly soldered together in the adult animals, but loosely joined in the young individuals. The tail also is covered by heavy plates. The total length of the skeleton varies from 12 to 20 feet. Armadillos with movable transverse rows of dermal plates are found fossil in the Tertiary deposits of Patagonia, and the earliest forms show no close points of relationship with the glyptodonts. The genera are *Chlamydotherrum*, *Dasyus*, *Eutatus*, and *Proeutatus*, of which the first mentioned attained the bulk of a rhinoceros. Compare **GANODONTA**.

**Bibliography.** Scott, *History of Land Mammals of Western Hemisphere* (New York, 1913); Matthew, "Ancestry of the Edentates," in *American Museum Bulletin*, vol. xii (ib., 1912); A. S. Woodward, *Outlines of Vertebrate Paleontology* (Cambridge, 1898); Nicholson and Lydekker, *Manual of Paleontology* (Edinburgh, 1889); Ameghino, *Enumération synoptique des espèces de mammifères fossiles des formations éocènes de Patagonie* (Buenos Aires, 1894); Marsh, "The Stylinodontia, a Suborder of Eocene Edentates," in *American Journal of Science*, 4th series, vol. iii (New Haven, 1897). Consult also the reports of the scientific expeditions sent by the American Museum of Natural History, New York. Princeton University, etc.

**EDENTON.** A town, formerly a port of entry, and the county seat of Chowan Co., N. C., 115 miles (direct) east by north of Raleigh, on Albemarle Sound, and on the Norfolk and Southern Railroad, and on the lines of two steamship companies (Map: North Carolina, F 1). It contains a United States fish hatchery,

and has extensive herring and shad fisheries, cotton mills, a peanut factory, and considerable lumber interests. The water works and electric-light plant are owned by the city. Founded in 1712, Edenton was originally known as Queen Anne's Creek and received its present name in honor of Charles Eden, an early Colonial governor. Here was held, on Oct. 24, 1774, the famous Edenton Tea Party, at which 52 women formally voted that they would not conform "to that Pernicious Custom of Drinking Tea" and "would not promote ye weare of any manufacture from England." Pop., 1910, 2789.

**EDER, a'dër, JOSEPH MARIA** (1855- ). An Austrian chemist. He was born at Krems and was educated at the University and the Polytechnic Institute of Vienna. In 1882 he was appointed professor of chemistry at the State Industrial School in that city and afterward assisted in the organization of the Imperial Educational and Experimental Institute for Photography, of which he was appointed director in 1888. Especially noteworthy are his investigations on the influence of light of various wave lengths upon silver salts, which resulted in the development of orthochromatic photography. He also invented a new photometric method and the now extensively used aristo papers (chlorogelatin papers). His publications include: *Die Momentphotographie in ihrer Anwendung auf Kunst und Wissenschaft* (2d ed., 1886; 2d series, 1888); *Anleitung zur Herstellung von Momentphotographien* (2d ed., 1887); *Photographie mit Bromsilbergelatine* (4th ed., 1890); *Versuch über Photographie mittels der Röntgenschen Strahlen*, with Valenta (1896); *System der Sensitometrie photographischer Trockenplatten* (1899-1902); *Beiträge zur Photochemie und Spektralanalyse*, with Valenta (1903); *Atlas typierter Spektien* (1911). He was from 1887 to 1911 editor of the *Jahrbuch für Photographie und Reproduktionstechnik*.

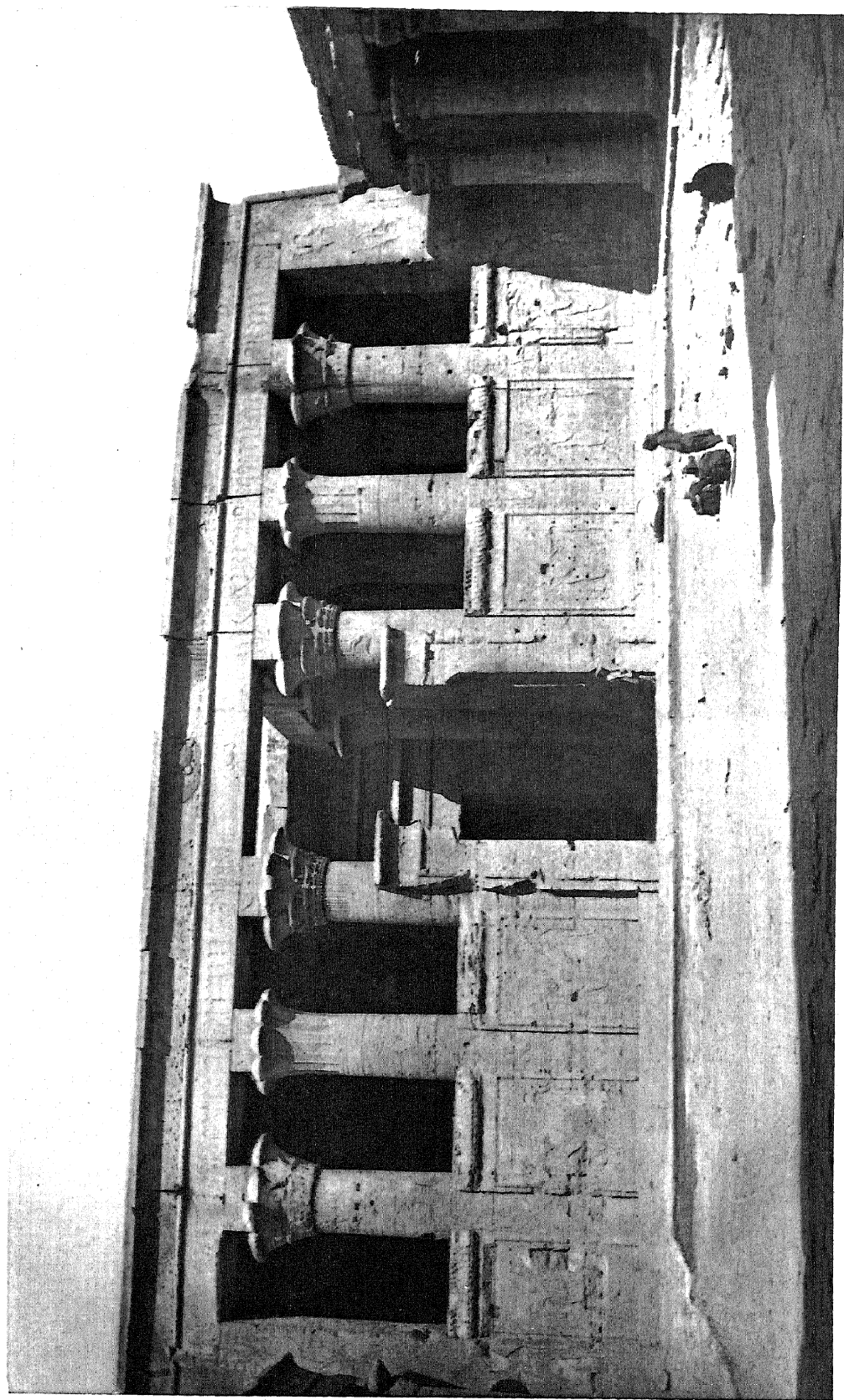
**EDERSHEIM, a'dërs-him, ALFRED** (1825-89). An English biblical scholar. He was born in Vienna, of Jewish extraction, and was educated at the university in that city. Unable to complete his university education because of financial obstacles, he accepted a tutorship in Pest, where he was converted to Christianity by John Duncan (q.v.). After studying theology in Edinburgh and Berlin, he was ordained to the Presbyterian ministry (1846) and soon afterward received an appointment to the Free church, Aberdeen, with which he remained associated for 12 years. He subsequently became select preacher to the University of Oxford (1884-85) and Grinfield lecturer on the Septuagint (1886-88, 1888-90). His principal work is entitled *The Life and Times of Jesus the Messiah* (1883), and he also published works entitled *Bible History* (of the Old Testament, 7 vols., 1876-87); *Jewish Social Life in the Days of Christ* (1876); *The Exodus and the Wanderings in the Wilderness* (1876).

**EDESSE, ROBERT** (1868- ). An American actor, born at New Orleans, La. He first appeared at the Park Theatre, New York City, in 1887, in *Fascination*. He starred in the following plays: *Soldiers of Fortune* (1902); *Ransom's Folly and Strongheart* (1905-07); *Classmates* (1907); *The Sinner* (1908); *The Call of the North* (1908, 1909); *The Offenders* (1908); *The Noble Spaniard* (1909); *The Outpost* (1909); *A Man's a Man* (1910); *The Cave Man* (1911); *The Indiscretion of Truth* (1912);

*Fine Feathers* (1913). He played the rôle of Ma-Wo-Cha-Sa in his own play, *Where the Trail Divides* (1910).

**EDESSE** (Lat., from Gk. Ἐδεσσα, *Edessa*). The ancient capital of Macedonia, formerly known as *Ægæ*. It was situated 46 miles west of Thessalonica, at the head of a defile commanding the approaches from the seacoast to the interior. It was the original residence of the Macedonian kings and was the burial place of the royal family long after it ceased to be the seat of government. In Edessa Philip II was murdered by Pausanias, 336 B.C. Alexander the Great (q.v.) was buried at Alexandria, but Edessa remained the royal burial place, and when Pyrrhus occupied the place the royal tombs were plundered by his Gallic mercenaries. In Roman times Edessa was an important post on the great road from Dyrrhachium to Thessalonica. The modern city of Voden (q.v.) is built on the site of Edessa, and only scanty remains of the ancient buildings are preserved.

**EDESSE** (modern name, *Urfah*, or *Orfa*). A very ancient city on the river Daisan, in the north of Mesopotamia (in the modern Vilayet of Aleppo), 78 miles southwest of Diarbekir. Though the town is of very early origin, it is with the conquest of Persia by the Greeks that the history of Edessa first becomes clearer. Seleucus, in particular, is said to have done much for the aggrandizement of the city, and its prosperity increased under an independent line of kings reigning just before and just after the beginning of the Christian era. Christianity was introduced into Edessa at an early period, and the supposed relations of King Abgarus and Christ are embodied in the famous letter found in Edessa by Eusebius at the beginning of the fourth century. (See *ABGAR*.) In the reign of Trajan the place was made tributary to Rome and in 216 A.D. became a Roman military colony under the name of Colonia Marcia Edessenorum. Edessa, Nisibis, Damascus, and Antioch were the four greatest cities of Syria. During this period its importance in the history of the Christian Church continued to increase. More than 300 monasteries are said to have been included within its walls; it was the birthplace, or, at any rate for a time, the headquarters, of St. Ephraim Syrus. Through the school founded by Ephraim it became the principal centre of Syrian learning and literature during the fourth, fifth, and sixth centuries and played an important part in the Arian and other controversies. Its famous university, or school of the Persians, was closed, on account of heretical tendencies, by the Emperor Zeno towards the end of the fifth century. With the extension of the religion of Islam in the seventh century Edessa fell into the hands of the Arabian caliphs. Christianity declined, and wars at home and abroad during the caliphate destroyed likewise the temporal splendor and prosperity of Edessa, till, in 1040, it fell into the possession of the Seljuk Turks. The Byzantine emperors succeeded in recovering Edessa, but the Viceroy contrived to make himself independent. He was, however, hard pressed by the Turks, and this rendered it easy for the Crusader Baldwin (q.v.), the brother of Godfrey of Bouillon, to gain possession of the city (1097 A.D.) and make it the capital of a Latin principality and the bulwark of the Kingdom of Jerusalem. Under the Frankish princes Edessa held out valiantly against the Mussulmans, till at length



EDFU  
TEMPLE OF HORUS  
THE GREAT COURT, AND THE ENTRANCE TO THE HYPOSTYLE HALL



Zengi, ruler of Mosul, succeeded in taking the town and citadel in the year 1144, when all the Christian churches were converted into mosques. An attempt made by the inhabitants to throw off the Mohammedan yoke completed the ruin of Edessa. Its inhabitants were defeated by Nur-ed-Din, and all who were not massacred were sold as slaves. After many vicissitudes, in the course of which Edessa fell successively into the hands of the sultans of Egypt, the Byzantines, the Mongols, Turkomans, and Persians, the city was finally conquered by the Turks in 1637, and has since formed a portion of the Turkish dominions. On its site stands the modern city of Orfa, or Urfa, with a population variously estimated at from 30,000 to 50,000, mostly Mohammedans. The modern city has numerous mosques and bazars, manufactures of cotton goods, goldsmiths' wares, and morocco leather, commerce in British manufactures obtained by way of Aleppo, and a large trade in grain, etc., with Syria. It is regarded by the Orientals as a sacred city, because they believe it to have been the residence of Abraham. In 1895, on October 28-29, there was a terrible massacre of Armenians by the Turks. A still worse massacre, involving, it is said, 8000 Armenians, followed on December 28-29 of the same year. (See ARMENIA, *History*.) Consult the article "Edessa in Osroene," by Meyer, in Pauly-Wissowa, *Real-Encyclopädie der klassischen Altertumswissenschaft*, vol. v (Stuttgart, 1905).

**EDFU**, ʾēd'fū (Coptic *Atbō*). A town of Upper Egypt, on the left bank of the Nile (lat. 25° 1' north, long. 32° 16' east), about 60 miles above Thebes. The chief local deity was Horus (q.v.), whom the Greeks identified with Apollo and for this reason called the place Appollinopolis. As *Apollinopolis Magna* it was distinguished from *Apollinopolis Parva* (the modern Qūs), the seat of worship of the god Haroëris (q.v.). Edfu was celebrated in Egyptian mythology as the scene of one of the great contests between Horus and Set. The legend is given in full in Wiedemann's *Religion of the Ancient Egyptians* (1897). The great temple of Horus at Edfu, which stands to-day almost intact, is in a better state of preservation than any other Egyptian temple. It was begun on the site of an older temple in 237 B.C., under the reign of Ptolemy III (Euergetes I), and was completed and dedicated under Euergetes II about a century later. Considerable additions were made to it by later monarchs down to the year 57 B.C. Including the court, it is some 451 feet in length, and its façade is 250 feet wide. A gateway, 50 feet high, between two immense pylons, over 100 feet in height and covered with inscriptions, gives entrance to a splendid court (161 × 140 feet) inclosed by a double colonnade of 32 pillars, each of a different design. At the upper end of the court is the great portico, its roof supported by 18 pillars, and then comes a hypostyle hall of 12 pillars. This gives access to two successive vestibules leading to the sanctuary, which is surrounded by an open corridor. A number of chambers, ranged along the wall of the temple, open into this corridor. From the pylons extends the outer wall which incloses the court and all the temple buildings in a single great quadrangle. The principal buildings are richly decorated with sculptures and paintings and contain numerous inscriptions, chiefly of a religious or mythological character. Both the court and the temple were formerly nearly cov-

ered up with rubbish, and Arab hovels were built against the walls and even upon the roof; but early in the sixties Mariette, by permission of the Khedive, cleared away the débris and removed the wretched buildings which encroached upon the temple.

The so-called Birth House, built by Euergetes II and decorated by Soter II, stands near the entrance of the great temple of Horus. It is surrounded by a gallery whose roof is supported by pillars adorned with figures of the god Bes. Consult: Lepsius, *Briefe aus Aegypten, Aethiopien*, etc. (Berlin, 1852); Brugsch, *Reiseberichte aus Aegypten* (Leipzig, 1855); Mariette, *Monuments of Upper Egypt* (London, 1877); Breasted, *Ancient Records of Egypt*, vol. ii, passim (New York, 1907).

**EDGAR**, or **EADGAR**, ʾēd'gēr (944-975). A king of the English, called Edgar the Peaceful. He was a son of Edward, or Edmund the Magnificent. In 957, as the leader of a revolt, he became a ruler of Northumbria and Mercia, and on the death of his brother Edwy, or Eadwig, in 958 he was called to the throne by the entire people, succeeding to the Kingdom of the West Saxons in addition to that which he already controlled. During his reign of 17 years he had for his chief adviser the able Dunstan, Archbishop of Canterbury. He brought about the establishment of national consolidation, the reformation of the clergy, the improvement of the judiciary system, and the formation of a fleet to defend the coast against the Norsemen.

**EDGAR**. The son of the Earl of Gloster, in Shakespeare's *King Lear*, whose ill treatment, wanderings, feigned madness, and sweet forgiveness of his unjustly suspicious father form the secondary plot of the play.

**EDGAR**, SIR JAMES DAVID (1841-99). A Canadian legislator and author, born at Hatley, in the Province of Quebec. He was educated at Lenoxville and at the city of Quebec, and was called to the bar in 1864. He was a Liberal member of the House of Commons from 1872 to 1874 and was reelected in 1884, 1887, and 1891. In 1889 he was instrumental in securing the passage of the Canadian Copyright Act. In 1894 he introduced the question of international arbitration, in the House of Commons, supporting it by a notably able speech and procuring the passage of a resolution in its favor. On the advent to power of Sir Wilfrid Laurier in 1896, he was appointed Speaker of the Commons and in 1897 became a member of the Queen's Privy Council. In addition to his contributions to the daily press he published two volumes of poems: *This Canada of Ours and Other Poems* (1893) and *The White Stone Canoe* (1885). He also published *The Insolvent Act of 1864* (1865).

**EDGAR ATHELING**, or **EADGAR THE ATHELING** (c.1057-c.1120). An English prince, a grandson of Edmund Ironside. He was born probably in Hungary, whither his father had been exiled by Canute. After the death of Edward the Confessor, Edgar was the nearest heir to the crown, which passed, however, to Harold; after the death of Harold, Edgar was chosen King at London, but was soon compelled to submit to William the Conqueror. Edgar's life was a succession of fruitless struggles, his most noteworthy achievement being his expedition into Scotland (1097) for the purpose of reinstating his nephew Edgar as King of that country. In 1099 he engaged in the Crusade and returned to England during the reign of



Henry I. His last years were spent in obscurity, and the date of his death is not known. Consult Freeman, *History of the Norman Conquest*, vols. iii-v (Oxford, 1873), and *Reign of William Rufus* (2 vols., ib., 1882).

**EDGARTOWN.** A town, port of entry, and the county seat of Dukes Co., Mass., on the east shore of the island of Martha's Vineyard, 27 miles (direct) southeast of New Bedford (Map: Massachusetts, F 7). It has a small but well-sheltered harbor and was formerly a whaling port. At present it is known chiefly as a summer resort, although some fishing is carried on. Edgartown was founded in 1642 and was incorporated in 1671. It contains a Carnegie library. Pop., 1900, 1209; 1910, 1191. Consult Banks, *History of Martha's Vineyard* (Boston).

**EDGEHILL.** A hill ridge in Warwickshire, England, 7 miles northwest of Banbury. It gave its name to the first great battle of the Civil War, which was fought there on Sunday, Oct. 23, 1642, between the Royalist forces under Charles and the Parliamentarians under the Earl of Essex. The King's forces had the advantage in numbers and in cavalry as well as in position upon the hill; Essex, however, had the more formidable train of artillery. He began the fight by firing upon the Royalists, who immediately replied with their cannon. The Royalists descended the hill, and Prince Rupert, who led the right wing, charged with his cavalry the left wing of the Parliamentarians, broke it, and pursued it to Kington, where his men, regardless of the main army, busied themselves in plunder. This was the fatal movement of the day. The right wing of the Parliamentarians had charged and recharged with the greatest success, until, after some stubborn fighting around the royal standard, the Royalists broke and retreated towards the hill. Disastrous to both armies, the result of the battle was indecisive. Over 4000 men were slain at the foot of Edgehill, and of these the greater number were Royalists.

**EDGERTON.** A city in Rock Co., Wis., 25 miles by rail southeast of Madison, on the Chicago, Milwaukee, and St. Paul Railroad (Map: Wisconsin, D 6). It contains a public library. Tobacco is the staple agricultural product, and nearly half the tobacco raised in the State is shipped from this place. The water works are owned by the city. Pop., 1900, 2192; 1910, 2513.

**EDGEWATER.** A borough in Bergen Co., N. J., opposite New York City, on the Hudson River, 6 miles north of Jersey City, and on the New York, Susquehanna, and Western and the Erie railroads (Map: New Jersey, E 2). The chief industrial establishments are large corn-product and sugar refineries, paper works, and chemical factories. Pop., 1900, 1006; 1910, 2655.

**EDGEWOOD.** A borough in Allegheny Co., Pa., 7 miles east of Pittsburgh, on the Pennsylvania Railroad. It is the seat of the Western Pennsylvania Institute for the Deaf and Dumb. Pop., 1900, 1139; 1910, 2596.

**EDGEWORTH, MARIA** (1767-1849). An Irish novelist of Irish and English life, who was born at Black Bourton, Oxfordshire, but whose home was at Edgeworthstown, Ireland. Her Irish stories were the first to make a careful study of provincial life and manners. As such, they represent a distinct step in the development of fiction in English and are the progeni-

tors of a countless family of similar productions, including Sir Walter Scott's novels of Scottish life. Sir Walter himself declares, in the preface to *Waverley*, that it was from her he took the idea of doing for Scotland what she had done for Ireland. Miss Edgeworth was also the first in English fiction to give careful and respectful attention to peasant life. Here, again, she proved a potent influence in modern fiction; and one of the greatest of novelists, Turgenev (q.v.), confesses (consult Anne Thackeray Ritchie's account of Maria Edgeworth in *The Book of Sibyls*, London, 1883) that his studies of the Russian peasant were suggested by like work of Miss Edgeworth. The best of her stories is *Castle Rackrent* (1800), which first introduced English readers to Irish life. It is a picture of the reckless, devil-may-care squirearchy of pre-Union days, and is recognized by good judges as a work of rare excellence in its kind. *Castle Rackrent* was followed by *Ennui* (1809), which is a study of an absentee landed proprietor; and after *Ennui* came *The Absentee* (1812), which presents a different aspect of absenteeism. In the fourth of her Irish novels, *Ormond* (1817), the life of the Catholic gentry of the old Celtic stock is the theme. The didactic strain, which came to her from her father, Richard Lovell Edgeworth (q.v.), is more or less of a blight upon her novels of English life, though certain of these are still highly entertaining and entitle her to a secure place among English novelists of the second rank. Of such are, notably, *Belinda* (1804), *Leonora* (1806), and *Helen* (1834). Her didacticism, pure and simple, found expression in her first considerable effort, *Practical Education* (1798), written in collaboration with her father, and it was pervasive in *The Parent's Assistant* and other books for children, which, but for this unfortunate infusion, might to-day be as popular as they were in their author's own generation. Consult, besides *The Book of Sibyls*, mentioned above: Emily Lawless, *Maria Edgeworth* (New York, 1904), inadequate, but a critical biography convenient in its brevity; A. J. C. Hare, *Life and Letters of Maria Edgeworth* (ib., 1895); W. D. Howells, *Heroines of Fiction* (ib., 1901), especially concerning the novels of English life; H. S. Krans, *Irish Life in Irish Fiction* (New York and London, 1903); Hill, *Maria Edgeworth and her Circle in the Days of Bonaparte and Bourbon* (New York, 1910).

**EDGEWORTH, RICHARD LOVELL** (1744-1817). An English author. He was born at Bath, was educated at Trinity College, Dublin, and Corpus Christi, Oxford, and began the study of law, but gave it up and settled upon the family estates at Edgeworthstown, County Longford, Ireland. Edgeworth's friendship for Dr. Erasmus Darwin inspired in him a love for science, and much of his writing was upon scientific subjects. To his closest friend, Thomas Day, he is said to have suggested the writing of *Sandford and Merton*. He was a member of the last Irish Parliament, and, disregarding personal considerations, voted against the proposition of a union with England. In 1785 he was one of the founders of the Royal Irish Academy and during the following two years devoted most of his time to mechanics and agriculture. Among his works are: *Letter to Lord Charlemont on the Tellograph and on the Defense of Ireland* (1797); *Practical Education* (1798); *Poetry Explained for Young People* (1802); *Professional*

*Education* (1808); *Readings in Poetry* (1816); *Essay on Construction of Roads and Railways* (1817). Consult *Memoirs* by himself and his daughter, Maria (London, 1820; 1844).

**EDGEWORTH DE FIRMONT, HENRY** ESSEX (1745-1807). An Irish clergyman, confessor to Louis XVI of France. He was born at Edgeworthstown (County Longford), was educated by the Jesuits at Louvain, France, was trained for the Roman Catholic priesthood in Paris, and upon his ordination assumed the additional name of De Firmont. Having worked among the Irish and English in Paris, he was in 1791 appointed confessor to the Princess Elizabeth, sister of Louis XVI, and was recommended by her to the King. After the condemnation of the King by the Convention on Jan. 20, 1793, he was summoned to the Temple, through Garat, Minister of Justice. Between 5 and 6 o'clock on the morning of the execution (January 21) he celebrated the mass, and later he rode with the King to the scaffold. He escaped to England, which he reached in 1796, and where he was offered by Pitt a pension, which he then declined, but in 1806 accepted. He followed Louis XVIII to Blankenberg and later to Mittau, where he died of a fever contracted while attending French prisoners. His epitaph was written by Louis XVIII.

**EDGREN, éd'g'ren, ANNE CHARLOTTE LEFFLER** (1849-92). A Swedish realistic novelist and dramatist, born in Stockholm, writing under the name of Leffler. She was twice married, first to Municipal Secretary G. Edgren (1872-89), then (1890-92) to the Italian Duke of Cajanello. Her short stories, collected under the titles *By Chance* (1869), *From Life* (1882-83), *A Summer Story* (1886), *Woman and Love* (1890), and her dramas, *The Actress* (1873), *The Curate* (1876), *The Fairy* (1880), *Ideal Women* (1883), *The Struggle for Happiness* (1887), and, most popular of all, *A Rescuing Angel*, are the most noteworthy and characteristic of her many works. There is a *Life of Edgren* by Ellen Key (1893).

**EDHEM PASHA, éd'hēm pá-shā'** (c.1813-93). A Turkish soldier and statesman, born of Greek parents on the island of Chios. In 1831 he was taken to Paris, where he was educated in engineering and made a special study of mining. Returning to Turkey in 1839, he was made a captain in the army and was assigned to duty in the topographical corps. He became an aid on the staff of the Sultan Abdul-Medjid in 1849, and rose rapidly to the position of general of a division and chief of the Sultan's military household. In 1854 he began his diplomatic career in a special mission to Serbia. In 1856, incurring the displeasure of the Sultan, he was removed from his official position, but shortly afterward was restored to power, made a member of the Council of the Tanzimat (the old theoretical constitution), and appointed Minister of Foreign Affairs. Under Abdul Aziz he held various positions of importance. In 1876 he was Ambassador at Berlin, and one of the representatives of the Porte at the international conference in Constantinople. Early in 1877 he was made Grand Vizier. From 1879 to 1883 he was Ambassador at Vienna.

**EDHEM PASHA** (1851-1909). A Turkish soldier. By 1877 he had become a colonel, and during the siege of Plevna was acting brigade commander. His bravery attracted the attention of the Porte, and his rise was rapid. He was

appointed Governor-General of the Vilayet of Kossovo, adj. 'ut + dicere, to say), and field marshal, and in 1897 . . . chief command of the Ottoman army in the Græco-Turkish War. He mobilized 55,000 troops in three weeks, defeated the Greeks at the Maluna Pass, marched into Thessaly, and entered Larissa. His direction of the army, both in the field and in its hospital and sanitary arrangements, was very skillful. See GREECE.

**EDIBLE BIRDS' NESTS.** See SALANGANE.

**EDIBLE FLIES.** See EPHYDRA.

**EDIBLE FUNGI.** See FUNGI, EDIBLE AND POISONOUS; MUSHROOMS.

**EDICT** (Lat. *edictum*, from *edicere*, to proclaim, from *e*, out + *dicere*, to say). A rule of law promulgated by a superior . . . The power of making edicts (*ius* . . . ) longed generally to the higher magistrates at Rome; but it was by the curule ædiles, and more extensively still by the two prætors—the *prætor urbanus* and the *prætor peregrinus*—that it was prominently exercised. As this power was co-extensive with the possession of what were called the honors (*honores*), it was frequently spoken of as the *ius honorarium*; and from its being exercised chiefly by the prætors, it was also known as the *ius prætorium*. The edicts of the prætors are mentioned by Gaius among the sources of the Roman law; but, strictly speaking, they are to be considered as rules promulgated by the magistrates on entering upon their office rather than as expressions of the will of the Roman people. The edict of one prætor was not binding on his successor, but, as edicts promulgated by one prætor were usually adopted and confirmed by his successors in office, they thus came gradually to acquire the character of law. Edicts which thus became a part of the permanent law of the Republic were frequently known by the names of their first promulgators, though they were often named with reference to the formula and the *actio* which they established.

The power of promulgating edicts is supposed to have been derived from the kings to the consuls, and through them to the prætors, and thus to have formed part of what we should call the royal prerogative. Even in Cicero's time the study of the edict had become a regular branch of the study of the law. In 67 B.C. the Lex Cornelia provided against the abuse of passing edicts for the decision of particular cases, by requiring the prætors to decide in conformity with the edicts which they promulgated upon assuming office, which were known as perpetual edicts (*edicta perpetua*). The object of the edict, according to the Roman jurists, was to aid, supplement, and correct the civil law, and to render it more conducive to the public service, and they speak of it as "the living voice of the civil law." It was, in short, an indirect form of legislation, which public opinion sanctioned for the public convenience, and there can be no doubt that, like the principles of equity promulgated by the chancellors in England, it contributed what was ultimately the most valuable part of the Roman law.

The edicts of the emperors, like those of the prætors, were also general rules, promulgated directly; but these had the superior validity which attached to the supreme magistracy and immediately took on the character of permanent law. They formed an important element in the *constitutiones*, in which the Imperial contribu-

tions to the law of the Empire were summed up. There were many commentators on the edicts under the emperors, among whom Labeo is mentioned and cited by Ulpian (*Dig.* 4, tit. 3, sec. 9). Julian is supposed to have collected and arranged the edicts and given to them a systematic form. Gaius, Ulpian, and Paulus composed treatises on the edicts of the curule ædiles; and it is chiefly from the writings of these and the other jurists excerpted in the *Digest* that we know anything of the character of the edict, the portions of it which have been preserved being mere fragments. They have been collected by Wieling in his *Fragmenta Edicti Perpetui* (Frankfort, 1733). See CIVIL LAW; CONSTITUTION; DIGEST; PANDECTS.

**EDICT OF NANTES**, nãnt. See NANTES, EDICT OF.

**EDILES**. See ÆDILES.

**EDINA**. A city and the county seat of Knox Co., Mo., 47 miles west by north of Quincy, Ill., on the Quincy, Omaha, and Kansas City Railroad (Map: Missouri, D 1). It has flouring and saw mills, a carriage and wagon factory, a nursery, a creamery, a cold-storage plant, etc. There is considerable trade in live stock and agricultural produce. Pop., 1890, 1456; 1900, 1605; 1910, 1562.

**EDINBURGH**, ɛd'n-bür-ū. A city and a royal and parliamentary burgh, the capital of Scotland and the county town of Edinburghshire, situated on a series of eminences about 2 miles south of the Firth of Forth and 47 miles east of Glasgow, in lat. 55° 57' N. and long. 3° 12' W. (Map: Scotland, E 4). It now includes the town of Portobello on the Firth of Forth, as well as various other outlying districts which were annexed in 1896 and subsequently. The mean altitude is about 200 feet above the sea level. Edinburgh is divided into the Old Town and New Town by a deep ravine, the former bed of the Nor' Loch, which has been turned into the charming recreation grounds of East and West Princes Street Gardens. The gardens are crossed by the North Bridge, the Waverley Bridge, and the Mound, an artificial embankment, on which are built the Royal Scottish Academy of Painting, Sculpture, and Architecture (founded 1826) and the National Gallery (founded 1850). The Academy, in the Doric style, was formerly the meeting place of the Royal Society (founded 1783) and the Society of Antiquaries of Scotland (founded 1780); it was the Royal Institution, the name being changed in 1910. The National Gallery contains a very complete collection of the Scottish school of painting as well as numerous examples of the old masters. The National Portrait Gallery and the Antiquarian Museum are housed in Queen Street. The Old Town, extending from the Castle on the west to Holyrood Palace on the east, contains the nucleus of the ancient burgh of Edinburgh, which grew up about the Castle, and the neighboring burgh of Canongate, which had its origin in the foundation of the abbey of Holyrood, and which retained its separate municipality until the extensions of 1856, when it became an integral part of Edinburgh. Two main streets running almost parallel intersect the Old Town: High Street—which is known throughout its length by five different names, viz., Castle Hill, Lawnmarket, High Street, Netherbow, and Canongate—and Cowgate.

The Castle occupies a rocky eminence 300

feet above the valley and is accessible only on its eastern side. The present edifice dates from the fourteenth century. It has frequently served as both a place of residence and a prison for the Scottish kings. It was here that Mary, Queen of Scots, gave birth to her son James. In the so-called crown room are kept the crown regalia, known as the *Honours of Scotland*. Holyrood Palace was the favorite residence of the Scottish monarchs and was the scene of some of the tragic events in the life of Mary, Queen of Scots. Among the other notable features of the Old Town are the parish church of St. Giles, the present edifice dating from the fourteenth century, restored 1879-83, with a handsome lantern spire, the burial place of the Marquis of Montrose and the scene of the signing of the Solemn League and Covenant; the old Tron Church, the house occupied for a number of years by the great reformer, John Knox; Parliament House (1632-40), formerly the meeting place of the Scottish Parliament, but utilized since the Union as the seat of the supreme courts and containing the Advocates' Library, with about 550,000 volumes, the largest in Scotland and one of the five in the United Kingdom entitled to a copy of every book published in the kingdom. It also contains the Signet Library (over 110,000 volumes). The churchyard of Canongate Church is the burial place of Dugald Stewart, Robert Fergusson, and Adam Smith, and Greyfriars' Churchyard contains the tombs of George Buchanan, Allan Ramsay, and Robertson the historian.

The chief thoroughfare of the New Town is Princes Street, which skirts the ravine separating the two towns and commands for its entire length an excellent view of the picturesque Old Town. In the eastern gardens facing Princes Street stands the Scott Monument, and at the easterly end of the street stand the Post Office and Register House, the latter being the repository for all title deeds and public records. Above these buildings rises the Calton Hill to a height of about 355 feet above the sea level, crowned by the Royal Observatory, Nelson Monument, and National Monument. It commands a magnificent panorama, excelled only by that obtained from Arthur's Seat, which rises to a height of 822 feet behind Holyrood. At the foot of Calton is the old Calton burial ground, which contains the grave of David Hume the philosopher and historian. In the New Town is St. Mary's Cathedral (Scottish Episcopal), in early Pointed style, with a 275-foot spire; it was opened for worship in 1879.

Edinburgh is governed by a city council, which elects from its own members a lord provost, a city treasurer, and seven bailies, who constitute the civil magistracy. The city sends four representatives to Parliament. In the matter of municipal undertakings Edinburgh has been most active. Its water and gas supplies are managed by a joint commission with Leith. Since 1895 it has successfully operated an electric-light plant at a substantial annual profit. It also owns its street-railway lines, which, however, are operated by a private company at a rental of about 7 per cent of the capital outlay. Baths, a public laundry, cemeteries, markets, and slaughterhouses are maintained by the corporation, and a considerable sum is expended annually in aid of technical education and for the maintenance of public

libraries. Following the lead of its sister city, Glasgow, Edinburgh has undertaken numerous schemes for the better housing of its working classes and has erected dwelling houses, which are let in flats at an exceedingly low rental. The city's system of sewerage has been much improved and has four separate outlets into the sea. Its garbage is disposed of in destructors or sold for fertilizing purposes.

Edinburgh has long borne an enviable reputation as an educational centre. At the head of its institutions of learning stands the University (q.v.). Other prominent institutions are the Heriot-Watt College; Heriot's Hospital, founded by a bequest of George Heriot, the jeweler of James VI; Donaldson's Hospital, Gillespie's Hospital, the Merchant Company's Schools, the high school, and Fettes College, the last named being modeled on the plan of Rugby and Eton. The Royal Infirmary, consisting of a series of detached buildings in the Scottish baronial style, is considered one of the most excellently equipped institutions of its kind in Europe. There are numerous parks and recreation grounds, including Queen's Park of nearly 700 acres, the Meadows, the Links, and Braid Hills.

Edinburgh is not an important manufacturing town; it, however, derives considerable commercial importance from its various banks and insurance offices. The principal industries are brewing (two-thirds of all the ale or beer brewed in Scotland being made in or near Edinburgh), printing and publishing with the kindred arts, distilling, iron founding, tanning, and coach building, manufacture of articles in India rubber, of house furniture, and of jewelry, and the rearing of young trees in nurseries in and around the town. Imports and exports amounted in 1905 to \$85,442,000 and \$37,110,000 respectively.

Edinburgh is the place of residence of considerable numbers of the Scottish landed gentry, and its society is regarded as unusually polished from the predominance of the professional and literary elements in its composition. This arises from its status as a university town and from the presence of the supreme law courts of Scotland. The picturesque and commanding situation of the city, combined with its literary fame, has acquired for it the name of the "Modern Athens." The climate is healthful, the mean temperature averaging 48° F., with an average rainfall of about 27 inches. Pop., 1801, 66,544; 1851, 160,352; 1901, 317,459 (area of the city, 10,094 acres); 1911, 320,318 (area, 10,877 acres).

Edinburgh is supposed to have sprung up round the castle built in the seventh century by Edwin, King of Northumbria (Eadwine's burgh). It quickly grew to be a place of importance and in the eleventh century was a royal residence. Around the abbey of Holyrood (q.v.), which David I founded in 1128, rose the town of Canongate, later annexed to old Edinburgh. From Robert the Bruce the burghers received a charter which granted them a great degree of self-government and the possession of the port of Leith. In the fifteenth century the Scottish kings sought refuge from their turbulent nobles in the castle of Edinburgh. After 1436 the town became the capital of the kingdom and the usual meeting place of Scottish parliaments. The Old Town, which was walled about 1450, was of very narrow limits. Under James II and James III numerous privileges and im-

munities were granted, notably the charter of 1452 and the Golden Charter of 1482. The city was closely connected with the chief events of Scottish history for the next 250 years, witnessing the fortunes of Mary Stuart (q.v.), the spread of the Reformation, and the battles of the Covenanters. After the Reformation the city became the seat of the youngest of the Scottish universities. The accession of James VI to the English throne in 1603, and the union with England in 1707, deprived Edinburgh of much of its political prominence, but it acquired instead great fame as the literary centre of Scotland, the home of Walter Scott, Jeffrey, and John Wilson ("Christopher North"). The New Town, planned by James Craig, dates from 1763, after the Nor' Loch had been drained and bridged. In 1843 Edinburgh, as the religious centre of Scotland, was the scene of the famous secession from the Established church which ended in the formation of the Free church of Scotland. The coronation ceremonies of King George V, in July, 1911, at Holyrood recognized afresh Edinburgh's position as capital of Scotland.

**Bibliography.** Grant, *Old and New Edinburgh* (3 vols., London, 1882); Gillies, *Edinburgh, Past and Present* (Edinburgh, 1889); Chambers, *Traditions of Edinburgh* (Philadelphia, 1912); Stevenson, *Edinburgh, Picturesque Notes* (New York, 1912); Oliphant, *Royal Edinburgh: Her Saints, Kings, Prophets, and Poets* (London, 1890); Gullard, *How Edinburgh is Governed* (Edinburgh, 1891); Wilson, *Memorials of Edinburgh in the Olden Time* (ib., 1891); Hutton, *Literary Landmarks of Edinburgh* (New York, 1898); Geddie, *Romantic Edinburgh* (ib., 1911); Smeaton, *Edinburgh and its Story* (ib., 1904); Fulleylove and Mason, *Edinburgh Painted and Described* (ib., 1905); Fyfe, *Edinburgh under Sir Walter Scott* (London, 1906); Watt, *Edinburgh and the Lothians* (New York, 1912); id., *Book of Edinburgh Anecdote* (ib., 1913); Wierter, *Story of Edinburgh Castle* (London, 1913); Watkeys, *Old Edinburgh* (new ed., Boston, 1913).

**EDINBURGH, ALFRED ERNEST ALBERT, DUKE OF** (1844-1900). The fourth child and second son of Queen Victoria. He was Earl of Ulster and of Kent and in 1893 succeeded his uncle as Duke of Saxe-Coburg and Gotha. He was educated by special tutors, went into the royal navy at the age of 14, and served chiefly on foreign stations. The crown of Greece was offered to him in 1862 by 230,000 out of 241,000 votes cast; but an agreement of Great Britain, Russia, and France, that the throne should not go to a noble of any one of these powers, prevented his acceptance. He married at St. Petersburg, on Jan. 23, 1874, Marie Alexandrovna, Grand Duchess of Russia. He was a good naval officer and became admiral of the fleet in 1893. He was an amateur in music and a collector of glass and pottery.

**EDINBURGH, UNIVERSITY OF.** A Scottish university which owes its origin to a bequest of Robert Reid, first Bishop of Orkney in 1588, and to the later encouragement of the municipality of Edinburgh. In 1563 the latter purchased ground on the site of "Kirk o' Field," and by grants of confiscated church property from Queen Mary, and a charter from James VI (James I of England) in 1582, the university was finally established. It was formally opened, and teaching begun, in 1583, though it was at

first, strictly speaking, only a college of arts. In 1642 a chair of theology was established and in 1685 one of medicine. After 1688 the institution, with other Scottish universities, was subjected to parliamentary visitation. At the beginning of the eighteenth century the present arrangement of the faculty of arts came into existence, and this, with the reorganization of the institution, including the establishment of a law faculty, gave it the rank and title of the University of Edinburgh which it has since held. Until 1857 the university had been almost entirely under the control of the municipality, but in that year, by the Act of Parliament regulating Scottish universities, the administration was vested in a self-governing corporation of members, the *senatus academicus*, and the university court, together with a body of curators selected partly by the university and partly by the city, in whose hands lay the patronage of the professional chairs. By the Universities of Scotland Act of 1899, the University Court was constituted as a body corporate, holding all property and having all powers of administration. It consists of the rector, principal, Lord Provost of Edinburgh, one assessor nominated by the chancellor, one by the rector, one by the Lord Provost, magistrates, and town council of Edinburgh, four by the general council, representatives of the affiliated colleges. The university senate, consisting of the principal and professors, regulates teaching and discipline. The general council, consisting of the chancellor, members of the court, professors, and graduates, reviews the measures presented to it, makes recommendations, elects the chancellor, and, with the general council of the University of St. Andrews, returns one member to Parliament. The chancellor confers degrees, sanctions changes in ordinances, and presides over the general council. The principal, elected by the curators for life, presides over the senate. The rector, an interesting mediæval survival found in Scottish universities, is elected by the students for three years and presides over the court. The office is almost invariably filled by some man, not necessarily connected with the university, who is distinguished in politics or letters, as Gladstone, Carlyle, Lord Rosebery, and Viscount Goschen. There are faculties of arts, science, divinity, law, medicine, and music. A students' representative council has certain rights of petition in matters affecting teaching and discipline.

Candidates for the M.A. degree traditionally must attend full courses in at least seven subjects; four—Latin or Greek, English or a modern language, or history, logic and metaphysics, or moral philosophy, and mathematics or natural philosophy—being required and three elective. Each course must consist of not fewer than 100 hours, or meetings of the class. For a degree with honors, special classes and courses are provided. Special regulations are in force for the higher degrees of D.Sc., D.Phil., and D.Litt., to all which women are admitted. The university grants also degrees in medicine, law, divinity, and music, of which those in medicine are open to women. There are a large number of bursaries (82) and many prizes, apportioned among the different faculties. The increase in the number of students and teaching force of the university led to a movement in 1869 for the enlargement of the buildings, and in 1878, sufficient sums having been raised, the "new

buildings" were begun. These, completed in 1888, together with McEwan Hall, finished in 1897, and the School of Music (1858), constitute the modern additions to the original buildings. The university library, which contains 270,000 volumes and 8000 manuscripts, was founded by Clement Little in 1580. There are, besides, a number of special libraries in theology, classics, philosophy, history, physiology, and music. The museums include that of natural history (1812) and a considerable number in various departments of learning, partly or wholly owing to the professors in the several subjects. The Royal Botanic Garden has also some connection with the university. The number of students in 1912-13 was 3352. In common with other Scottish universities the University of Edinburgh has been benefited by the grants of the Carnegie Trust. Long is the list of worthies: Blair, Akenside, Thomson, Hume, Goldsmith, the geologist Hutton, Scott, Palmerston, Carlyle, Earl Russell, Stewart, Darwin, Robertson of Brighton, Robert Louis Stevenson, Crockett, Sir James M. Barrie, and Sir Conan Doyle. Its professors have been equally distinguished: Dalziel, Dalziel, Stewart, Sir William Chalmers, John Wilson, Aytoun, Masson, and his successor, Saintsbury. Consult: Grant, *Story of the University of Edinburgh* (Edinburgh, 1884, best account); Dalziel, *History of the University of Edinburgh* (ib., 1862); J. Kerr, *Scottish Education, School and University from Early Times to 1903* (Cambridge, 1904); *University Calendar*.

**EDINBURGH REVIEW.** The first of the great critical periodicals which form a distinguishing feature of the literature of the nineteenth century. It was started in October, 1802, by a group of young men living in Edinburgh, the principal of whom were Francis Jeffrey (q.v.), Sydney Smith (q.v.), Francis Horner, and Henry Brougham (q.v.). So much was secrecy felt or believed to be necessary to the success of the undertaking that, according to the account which Jeffrey gave to Robert Chambers in 1846, "the dark divans" of the reviewers were held for some time "in a dingy room off Willison's printing office in Craig's Close," to which each repaired alone, and "by back approaches or different lanes." Of the first number, 750 copies were printed; the demand exceeded this limited supply; 750 more were thrown off, and successive editions followed. In 1808 the circulation rose to about 9000 and in 1813 to about 13,000. The original publisher was the well-known Constable. Sydney Smith edited the first three numbers and was then succeeded by Jeffrey. The influence of the *Edinburgh Review* in developing and strengthening the political convictions of the Whig party cannot be overestimated; but its power was even more visible, certainly more immediately palpable, in literature. The keenness of criticism, the sharpness of wit, and the brilliancy of style exhibited by the writers created a sensation in the world of letters; and although in the case of Wordsworth, Southey, and other writers of the Romantic school, unfairness of a flagrant kind was undoubtedly exhibited and persevered in, yet rough justice was, on the whole, administered. After the period of Jeffrey the most brilliant contributor to the *Edinburgh Review* was Macaulay. It is now published in London. Consult Napier, *Life and Correspondence* (London, 1862).

**EDINBURGHSHIRE**, **EDINBURGH**, or **MID-LOTHIAN**. A county in southeastern Scotland, lying on the south side of the Firth of Forth (Map: Scotland, E 4). Area, 366 square miles; while the county has but 1.2 per cent of the total area of Scotland, it has 10.7 per cent of the population. From the southern border, the Pentland Hills (mean height, 1000 feet, and highest point, Scald Law, 1898 feet) and the Moorfoot Hills (mean height, 800 feet, and the highest point, Blackhope Scar, on the Peeblesshire boundary, 2136 feet) run northeast through the country. In the north are fertile plains, varied by gentle slopes. The principal streams, none of which is large, are the Esk, Water of Leith, Almond, and Gala Water. The coast has coal-mining and other industries, but the county is chiefly agricultural, with large farms. Near Edinburgh are extensive nurseries, vegetable and fruit gardens, and dairy pastures. The leading manufacturing industry is paper making. Exclusive of Edinburgh and Leith, the county forms a single parliamentary constituency. In 1801 the population of Edinburghshire was 122,597; in 1851, 259,435; in 1871, 328,379; in 1891, 434,159; in 1901, 488,796; in 1911, 507,666. The principal burghs are Edinburgh, the county town and capital of Scotland, with 320,318 inhabitants in 1911; Leith, its seaport, 80,488; and Musselburgh, 15,938.

**EDISON**, **THOMAS ALVA** (1847- ). A celebrated American electrician and inventor. He was born at Milan, Ohio, Feb. 11, 1847, and when he was seven years of age his family moved to Port Huron, Mich., where the remainder of his boyhood was passed. While a mere lad, he started in business as a newsboy on the Grand Trunk Railway. His spare hours were spent in reading and in boyish experiments, largely with printing presses and electrical and mechanical apparatus. In 1862 he published a weekly, known as the *Grand Trunk Herald*, and did the printing in a freight car that also served as a laboratory where he could carry on further experiments. For saving the child of a station master from the wheels of an approaching car, he was received as a pupil at the telegraph office at Mount Clemens and there learned to become an operator. While a brilliant and rapid operator, he was besides fun-loving and erratic, as well as too fond of experimenting and disregarding the rules of the office to remain long in any one situation. It was while thus engaged that he made his first important invention, a repeating instrument, which enabled a message to be transmitted automatically on a second line without the presence of an operator. From the West Edison went to Boston, where, owing to his skill as a rapid operator, he soon secured a position and was also able to work on various mechanical inventions which suggested themselves to his ingenious mind. Among these was a vote recorder, which, while accomplishing its object, did not possess merits of a sufficiently practical character to warrant its adoption. Recalling this failure, Mr. Edison said that afterward he investigated minutely the necessity of any particular invention before he attempted to reduce it to practice. In this has been his great success as an inventor. Few, if any, great scientific discoveries are to be credited to Edison, but he has triumphed over almost insurmountable difficulties, and by his skill and ingenuity brought to practical use and the advancement

of civilization what had often been suggested by some scientific investigator unable to bring it to a successful outcome or practical realization. While in Boston, Edison devised and partly completed a stock-quotation printer and later became connected with the Gold and Stock Telegraph Company of New York, whose apparatus and service he greatly improved. Valuable inventions of stock printing and other telegraph appliances were sold for \$40,000, which enabled Edison to establish a laboratory on his own account and to work out some of his more important ideas. About this time came his automatic telegraph system, by means of which increased speed and range of action were obtained. Edison's crowning achievement in telegraphy (see **TELEGRAPH**) was his invention of the quadruplex system, which followed a duplex system he had previously devised, and which was a great commercial success and made possible a far greater use of existing telegraph lines. Of the greatest value in the development of the telephone (q.v.), then recently invented by Bell, were the microphone and the carbon transmitter, and the latter of these devices was employed extensively in the earlier instruments. In 1878 Edison brought out his phonograph with the tin-foil cylinder, and about this time the megaphone. The most used of all Edison's inventions, and the one that required the most careful research and experimenting to secure its perfection, was that of the incandescent light, which, brought out in 1879, was publicly exhibited in 1880. This new light soon achieved a remarkable success, and the inventor was fully occupied in improving the lamps themselves and the dynamos for generating the current. Mr. Edison also worked on the question of electric traction, but his achievements here, while attended with some success, were not so remarkable as in other fields. In 1886 his laboratory at Orange was built and furnished a commodious workshop for his later experiments. Here the kinetograph was developed, and the instrument in its well-known form of the kinetoscope was made a commercial success. Among his commercial ventures were the magnetic treatment of iron ore and a plant for the manufacture of Portland cement. The most notable of his later inventions is the nickel-iron storage cell, the product of many thousands of experiments in which Edison struck out boldly from all existing knowledge and precedent. This type of battery is extremely rugged, is practically incapable of electrical injury, and has a very high capacity per unit of weight. Its great field of service is the propulsion of vehicles and railway cars. He also brought out a disk phonograph with a diamond-point reproducer and other excellent features, and by synchronizing his phonograph and kinetoscope he produced (1913) realistic talking motion pictures. Edison received numerous honors at international expositions and from foreign governments, among which are his appointment as Chevalier of the Legion of Honor from France in 1878 and as Commander in 1889. In 1892 he received the Albert medal of the Society of Arts of Great Britain. Edison as an inventor stands unique among those men of the nineteenth century who applied scientific discoveries to the ordinary uses of man. His boldness in overcoming experimental difficulties, and his successful achievement of what might be termed all but impos-



sible, secured for him the name of Wizard. In considering his life and work, however, the distinction must be made between the pure scientist with mathematical and philosophical knowledge, and the ingenious inventor who can apply a scientific truth to a practical end. Of this latter class Edison stands at the head. For a life of Edison, consult Jones, *Thomas Alva Edison* (New York, 1908), and Dyer and Martin, *Edison: His Life and Inventions* (2 vols., ib., 1910).

**EDISTO ISLAND.** One of the "sea islands" so famous for long-staple cotton, on the South Carolina coast, about 25 miles southwest of Charleston (Map: South Carolina, D 4). It is formed by the branching of the Edisto River (q.v.) near the coast. The soil is fertile, and the vegetable trade of the island with the North is considerable. Pop., 1910, 3234.

**EDISTO RIVER.** A river in the southern part of South Carolina, formed about 6 miles west of Branchville, Orangeburg County, by the union of its north and south forks (Map: South Carolina, D 3). It flows southeast, then south, and divides into the North and South Edisto about 15 miles from the coast. These arms embrace Edisto Island and reach the Atlantic about 25 miles southwest of Charleston harbor and just north of St. Helena Sound. From the forks to its mouth the river is about 150 miles long, and it is navigable for light-draft boats.

**EDISTO PRINCIPIS**, ē-dīsh'i-ō prīn'sēps. The Latin term for the first edition of a book. The term is used especially with reference to the first printed edition of a Greek or Latin author. See INCUNABULA.

**EDLUND**, ēd'lund, ERIK (1819-88). A Swedish physicist. He was born in the District of Nerike and was educated at Upsala. In 1850 he became professor of physics at the Royal Academy of Sciences in Stockholm and in 1858 was instrumental in securing the introduction of meteorological stations in Sweden. He conducted these observatories until 1873, when a central meteorological station was erected. His scientific researches were confined chiefly to the theory of electricity. His publications include *Théorie des phénomènes électriques* (1874), in which he discusses unipolar induction, tracing the origin of electricity to the rotation of the earth and of the higher strata of the atmosphere. The meteorological observations made by Edlund from 1858 to 1873 were published in 14 vols. by the Academy of Sciences of Stockholm.

**EDMONDSON**, THOMAS WILLIAM (1869- ). An American mathematician, born at Skipton-in-Craven, Yorkshire, England. After graduation from the University of London he studied at Cambridge and also at Clark University, Worcester, Mass. He was assistant professor of physics and associate professor of mathematics at New York University between 1896 and 1905 and thereafter professor of mathematics. His publications include: *Worked Examples in Coördinate Geometry* (1891); *Mensuration and Spherical Geometry* (1893), with W. Briggs; *Deductions in Euclid* (1901), and other mathematical textbooks. He was a contributor on astronomy to the second edition of the *NEW INTERNATIONAL ENCYCLOPÆDIA*.

**EDMONTON**, ēd'mon-ton. A city and the capital of the Province of Alberta, Canada, 192 miles north by northeast of Calgary (Map: Al-

berta, G 5), on the Canadian Pacific, the Grand Trunk Pacific, and the Canadian Northern railroads, and on the north branch of the Saskatchewan River. The city is laid out in wide, rectangular streets. The principal edifices are the Parliament buildings, the University of Alberta, the high school and public school buildings, Albert College, Robertson College, and a Roman Catholic convent and seminary. The manufacturing and industrial establishments include meat-packing plants, brickyards, saw mills, flour mills, elevators, foundries, machine shops, box and casket works, and manufactories of woodwork, aerated water, cigars, shoe packs, clothing, beer, and bottles. Coal mining and lumbering have reached great proportions, and there are 30 coal mines in or near the city. Abundant supplies of timber and stone are found in the surrounding district. In 1910 the value of the manufactured products amounted to \$4,493,304, as compared with \$243,778 in 1900. The city owns and operates its electric-light and power, water, telephone, and street-railway systems. Natural gas exists in the vicinity, and oil is indicated in the territory tributary to it. Alluvial gold is found in the vicinity. The city is in a fertile district and is an important station, being an old Hudson's Bay Company post. Edmonton has a meteorological station in daily communication with the United States Weather Bureau and is statistically the storm centre of the northern part of America. Pop., 1901, 2626; 1911, 24,900.

**EDMONTON.** An urban district of Middlesex, England, about 7 miles north of London in the Lea valley. Many artisans of the region have their homes here. Charles and Mary Lamb are buried in the churchyard, and the Bell Inn was made famous in Cowper's humorous poem of "John Gilpin." Pop., 1901, 46,899; 1911, 64,820. Consult Robinson, *The History and Antiquities of Edmonton* (London, 1819).

**EDMUND**, or **EADMUND** (AS., defender of property) (c.922-46). King of the English from 940 to 946. He was the son of Edward the Elder and the grandson of Alfred the Great and succeeded his half brother, Æthelstan, on the throne. Three years before his accession he had shown remarkable bravery in the battle with the Danes at Brunanburh. Soon after he became King a revolt broke out in the north, and Olaf, or Anlaf, the leader of the Danes from Ireland, was made King. For a time the revolt was successful, and the Dane-law (q.v.) was revived under a second Olaf and Ragnar; but about 944 Edmund subdued both kings. In 945 he conquered Cumbria and gave it to Malcolm of Scotland to be held in military service. Edmund was slain by an outlaw, May 26, 946, while at a banquet. Consult: Green, *Conquest of England* (London and New York, 1883); Hodgkin, *History of England, to the Norman Conquest* (London, 1906); Oman, *England before the Norman Conquest* (ib., 1910).

**EDMUND**, or **EADMUND** (c.981-1016). A king of the English, known as IRONSIDE. He was the son of Æthelred II, and half brother of Edward the Confessor. He is celebrated chiefly as the great opponent to Canute and the Danish party during the latter part of his father's reign. On the death of Æthelred, in 1016, the Danes proclaimed Canute King of England, but the citizens of London declared for Edmund,



who drew together his forces and engaged Canute at Pen, in Somersetshire, and at Sherston, in Wiltshire. In both battles he was victorious; but a severe defeat which he sustained at Assandun in Essex compelled him to make terms with the enemy. An arrangement was entered into by which England was divided between the two kings—Canute obtaining possession of the north, and the south falling to the share of Edmund. It seems probable that it was also agreed that on the death of either the survivor was to succeed him. Edmund died a few weeks after this agreement had been concluded, and Canute became King of England, Nov. 30, 1016. According to the *Anglo-Saxon Chronicle*, Edmund received the surname of Ironside for his extraordinary courage and physical strength. Consult: Freeman, *The Norman Conquest*, vol. i (Oxford, 1873); Green, *The Conquest of England* (London and New York, 1883); Hodgkin, *History of England, to the Norman Conquest* (London, 1906); Oman, *England before the Norman Conquest* (ib., 1910).

**EDMUND.** The bastard son of the Earl of Gloster, in Shakespeare's *King Lear*.

**EDMUND, SAINT** (c.1170-1240). An English archbishop and ascetic. His name was Edmund Rich. He was born at Abingdon between 1170 and 1175. He early adopted the ascetic life and followed its rules with a rigor amounting to heroism. He studied at Oxford and Paris and became a priest. In 1227 he was one of the preachers of the Sixth Crusade. In 1234 he became Archbishop of Canterbury. He was involved in many disputes and quarrels, both political and ecclesiastical. In 1240, broken down by such contentions and his severe mode of life, he left his post and went to Pontigny, in France, soon after to Soisy, where he died Nov. 16, 1240. For his life, consult: Masse (Eng. trans., London, 1874); Wallace, (ib., 1893); Ward (ib., 1903).

**EDMUNDS, ALBERT JOSEPH** (1857- ). An American librarian and Buddhist scholar, born at Tottenham, Middlesex, England. He entered the University of London in 1877, served as a secretary, spent 1884 in cataloguing the Sunderland (England) library, and then came to the United States. In 1887-89 he was assistant librarian of Haverford College, in 1889-90 he classified the Philadelphia library, and in 1891 became cataloguer of the Historical Society of Pennsylvania. Besides articles on comparative religion, he is author of *English and American Poems* (1888); *Songs of Asia Sung in America* (1896); *Marvelous Birth of the Buddhas* (1899); *Hymns of the Faith (Dhammapada)* (1902); *Buddhist and Christian Gospels* (1902; 4th ed., 1908-09); *Buddhist Bibliography* (1903); *Buddhist Texts Quoted as Scripture by the Gospel of John* (1906-11); *Fairmount Park and Other Poems* (1906); *A Duet with Omar* (1913).

**EDMUNDS, GEORGE FRANKLIN** (1828- ). An American lawyer and legislator. He was born at Richmond, Vt., was educated in a common school and by a private tutor, studied law, and in 1849 was admitted to the bar. He settled in Burlington in 1851 and from 1854 to 1859 was a member of the State Legislature, being for three years Speaker of the Lower House. In 1861-62 he served in the State Senate and was President pro tem. When the Civil War broke out, he was a member of the State

Convention which met to form a coalition between the Republicans and the War Democrats, and he drew up the resolutions adopted by that convention as the basis of union. At the death of Solomon Foot, in 1866, Edmunds was appointed to fill the vacancy from Vermont in the United States Senate, and held office until his resignation in 1891. In the Senate he served on the committees on Commerce, Public Lands, Pensions, Retrenchments, and the Judiciary. He was a member of the Electoral Commission (q.v.) in 1877, was for several years at the head of the Senate Judiciary Committee, and was President pro tem of the Senate during Arthur's administration. He was the author of the Anti-Polygamy Act of 1882, known as the Edmunds Act, of a somewhat similar Act passed in 1887, and of the Anti-Trust Law of 1890. After retiring from the Senate he practiced law and attained great eminence as a constitutional lawyer. In 1897 he became chairman of the Monetary Commission appointed by the Executive Committee of the Indianapolis Monetary Conference.

**EDMUNDSON, GEORGE** (1848- ). An English clergyman and historian, born in Redcar, York, and educated at Magdalen College, Oxford. He was ordained a priest of the Church of England in 1874, but is best known as a special student of the history of the Low Countries and of South America. In 1901-04 he was employed in preparing the British case in the Guiana-Brazil boundary dispute. He contributed several chapters to the *Cambridge Modern History* and published: *Milton and Vondel* (1885); *Archbishop Laud and his Work* (1905); *Anglo-Dutch Rivalry in the First Half of the 17th Century* (1910, Ford Lectures at Oxford); *The Church in Rome in the First Century* (1913, Bampton Lectures).

**EDMUNDSTON.** A town and the county seat of Madawaska Co., New Brunswick, Canada, situated on the Canadian Pacific, Grand Trunk Pacific, and Temiscouata railways (Map: New Brunswick, A 1). It contains a Roman Catholic convent and is the centre of a lumbering and farming district. The town owns its water and electric-light and power systems. Pop., 1901, 444; 1911, 1821; 1914 (local est.), 2600.

**EDOM** (Heb. *edōm*, red, Gk. *Ἰδουμαία*, *Idoumaia*). According to the Old Testament, which places Esau in possession of Edom, the latter becomes one of the names of Esau, fancifully explained because of the "red" pottage given him by his brother Jacob (Gen. xxv. 29-34). (See **ESAU**.) The ruddy hue of the sandstone cliffs may have had something to do with the naming of the region. The name, under the form *Udumu*, occurs in the Tell el-Amarna Tablets (c.1400 B.C.). It is designated as a city, and since in later Assyrian inscriptions it is sometimes designated in the same way, though also as a country, it has been concluded that the district received its name from its chief city. Another and apparently older name was *Seir*, which is the designation of the mountain range. Originally in the possession of the Horites, it passed into the hands of the Edomite group. The latter, however, did not drive out the former, but intermarried with them (Deut. ii. 22; Gen. xxxvi. 20-21).

Edom comprised a strip of country, 100 miles long by 20 miles broad, lying between the south of Palestine and the Gulf of Akabah (q.v.). It is a wild, mountainous region, with the desert on the east and west of it; but, rugged though

it looks, it contains rich glens and terraces, where flowers and shrubs and trees spring up luxuriantly. Its chief city in later periods was Bozrah (now Buseirah) in the extreme north; its seaports were Elath and Ezion-geber in the extreme south at the head of the Gulf of Akabah. The relations between the Hebrews and Edomites, despite the recognition of their close relationship, were for the most part hostile, and this hostility is carried back in historical traditions to the time when the Hebrews were refused permission to pass through Edom on their way to Canaan (Num. xx. 14-21) and were obliged to pass eastward of the land and make their way to Moab. During the reigns of David and Solomon the Edomites were brought under subjection to the Israelites, and despite many uprisings (1 Kings xi. 14-22; 2 Kings viii. 20-22, xiv. 22) they remained in the power of Judah until the time of Rezin of Damascus (2 Kings xvi. 6); nevertheless the Edomites repeatedly ravaged the southern border of Palestine and rejoiced when Judah was destroyed, which circumstance is the reason that they are so terribly denounced by some of the prophets (Lam. iv. 21-22; Ezek. xxxv. 3-15; Obad. 10-16).

In the Assyrian inscriptions Edom is frequently mentioned. In 732 B.C. the Edomitish King, Kaushmalak, appears among those who are forced to pay homage to Tiglath-pileser IV at Damascus, while 20 years later he and Judah again joining a league with Moab, Judah, Philistia, and Egypt, against the Assyrian King Sargon II. The allies were obliged to submit and pay tribute. Once more, in 701 B.C., when Sennacherib threatened Palestine and Syria, Edom joined with Hezekiah in an attempt to withstand the attack. In view of this, it is rather strange to find the inference in the Old Testament narratives that at the time of the attack of Nebuchadnezzar upon Jerusalem the Edomites assisted the Babylonians. In the post-exilic period the Edomites are enabled to extend their domain and occupy a portion of southern Judah, with Hebron as a capital, and during the Maccabean War the Jews had to contend not only with the Greeks, but with the Edomites as well, who endeavored to avail themselves of the situation by making attacks upon the Jews. Judas Maccabeus, however, drove them from southern Judah (164 B.C.) and John Hyrcanus (109 B.C.) is said to have conquered their country, though he held only the western part of it, and that not for a long time. The eastern part, with its capital at Selah (of which Petra is the Greek translation), remained in the hands of the Nabataeans, who had held it since before 312 B.C. The Roman conquest swept away the last remnant of the Edomitish independence. The country, now called after the Greek form *Idumæa*, was placed under control of a procurator and grouped with Judæa, Samaria, and Galilee; and Antipater, an Idumæan, succeeded, by gaining the favor of the Romans, in obtaining this position. His son was the famous Herod the Great. (See ANTIPATER; HEROD.) After the destruction of Jerusalem the country was merged in Arabia Petrea, and the name *Idumæa* disappears, being merged in the land of the Nabataeans.

Consult: Winckler, *Geschichte Israels* (1895); F. Buhl, *Geschichte der Edomiter* (1893); A. Musil, *Arabia Petrea*, vol. ii, "Edom" (1903); Brännöw and Dowszewska, *Die Provincia Arabia*, vol. i (1904); Hoskins, *The Jordan Valley*

and Petra (1905); Dalman, *Petra* (1908). See PETRA.

**ED'RED**, or **EADRED** (?-955). A king of the English. He was the son of Edward the Elder and succeeded his brother, Edmund I, in 946. The Danes in Northumbria were in revolt during most of his reign, but were finally subdued. He was succeeded by his nephew Edwy, or Eadwig, in 955. Consult Green, *Conquest of England* (London and New York, 1883).

**EDREMID**, a'dre-méd', or **ADRAMYTI**. A town of Asiatic Turkey, situated in the Vilayet of Brusa, about 3 miles from the Gulf of Adramyti. It lies in a very fertile region abounding in vineyards and olive groves. The town in itself is rather unpretentious, but derives considerable importance from the proximity of iron deposits in Mount Ida and its trade in oil, raisins, and timber. The population is a little over 8000, of whom about one-fourth are Greeks. The ancient city of Adramyti, situated nearer to the coast, was a very important commercial port.

**ED'RISI**, **ABU ABDALLAH MOHAMMED AL SHARIF**, called also **AL ED'RISI** (1099-?). An eminent Arabian geographer, born at Ceuta in 1099. By descent he was a member of the famous Edrisi family, which in turn traced its line to Mohammed himself. He studied at Cordova, where he devoted himself to geography, astronomy, and medicine. Having completed his studies, he traveled through Asia Minor, Egypt, Morocco, Spain (some say also England and France), and Portugal. On the invitation of Roger II, of Sicily, he went there and began a geographical work which he finished in 1154. From his own notes and from outside information he constructed a globe of silver. This, in accordance with the Ptolemaic system, he divided into seven climates, intersecting each with 11 regions, represented by perpendicular lines. In explanation he wrote a book. In 1592 this work was published at Rome in Arabic, while a Latin translation of it, under the title *Geographia Nubiensis*, was made in Paris (1619) by Gabriel Sionita and Johannes Eronita. Dozy published a portion of it, *Déscription de l'Afrique et de l'Espagne*, in 1866. Another portion, *L'Italia*, has been published by Amari and Schiaparelli (1883). Jaubert published a complete translation in French (1836-40), but the translation is untrustworthy. The description of Syria and Palestine in Arabic with a Swedish translation will be found in Brandel, *Om och ur den arabiske Geografen Idrisi* (Upsala, 1894). Another section is given by Nöldeke, *Ein Abschnitt aus dem arabischen Geographen Idrisi* (Dorpat, 1875). Consult also: Saavedra, *La geografía de España del Edrisi* (Madrid, 1885); Tomaschek, "Die Handelswege in 12ten Jahrhundert nach den Ekkundungen des Arabus Idrisi," in *Sitzungsber. d. Wiener Ak. d. Wiss.* (1887); Brockelmann, *Geschichte der arabischen Litteratur*, vol. i, p. 477 (Weimar, 1898).

**ED'SALL**, **SAMUEL COOK** (1860- ). An American Protestant Episcopal bishop, born at Dixon, Ill., and educated at Racine College and Western Theological Seminary. He was ordained to the priesthood in 1889 and in the same year was appointed to the rectorate of St. Peter's Church, Chicago. After an activity here of 10 years he became Missionary Bishop of North Dakota, serving until 1901, when he was elected Bishop of Minnesota. He wrote *Prayer Book Preparation for Confirmation* (1898).

**ED'SON, CYRUS** (1857-1903). An American physician, born at Albany, N. Y. He studied at Columbia and the College of Physicians and Surgeons. In 1882 was appointed assistant sanitary inspector of New York City, and rose to be health commissioner. In 1893 he was appointed health commissioner of the State of New York. He was three times elected president of the Board of Pharmacy of the City and County of New York. He was known as a bacteriologist, invented several surgical instruments, and wrote a large number of articles on sanitary and medical topics.

**EDUCATION** (Lat. *educatio*, from *educare*, to rear, nourish, bring up, from *educere*, to lead out, from *e*, out + *ducere*, to lead). In a general sense, the development of the whole nature of man, physical, intellectual, and moral, through interaction with every phase of his environment; in a narrower and more usual meaning, the development of the powers or capacities of the mind through special processes of training. No one application of the term has now or ever had a common acceptance, for it may have a variety of special applications. Quintilian applied it to the general process of training in the child's earliest years, in contrast to the formal school processes, called instruction. The Greek idea of education included both the early process of training, or formation of habits based upon authority, and the later process of instruction, or the rationalizing of the habits formed. This general conception is formulated by Plato as follows: "Good education is that which gives to the body and to the soul all the perfection of which they are capable." For many years the popular idea has been limited to the narrower one of instruction, but recently, under the influence of the conception of evolution, it has been realized that every stimulus that sets up a series of reactions in the human organization has some influence in shaping the final character. However, such a conception is too vague to be of any general value, and some such formulation as the following is now of common acceptance: Education includes all those processes consciously adopted by a given society for realizing in individuals the ideals which are approved by the race or by the particular group; while instruction includes all those definite means and methods adopted under the direction of a particular institution, usually the school, for accomplishing certain particular ends, wholly or for the most part of an intellectual character. The greater part of this article will be devoted to a sketch of the theory of education, with enough detail of the actual practice to illustrate the true nature of the theory. This presentation is supplemented in the articles relating to the prominent educators of the past, especially those about Abélard, Alcuin, Aristotle, Basedow, Comenius, Fellenberg, Fröbel (or Froebel), Herbart, Locke, Horace Mann, Montaigne, Pestalozzi, Plato, Quintilian, Rabalais, Ratichius, Rousseau, Herbert Spencer, Sturm. A further discussion of the principles of education, especially in relation to their application as an art, is given in the articles on **PEDAGOGY** and on **PSYCHOLOGY**. The subject of educational method, treated primarily in the article on **PEDAGOGY**, is treated in some of its aspects in the articles on **BASEDOW**; **COMENIUS**; **FRÖBEL**; **HERBART**; **JACOTOT**; **LANCASTER**; **JOSEPH**; **NORMAL SCHOOL**; **OBJECT TEACHING**; **PESTALOZZI**. The present condition of educational systems

and practices, together with a sketch of their historical development since the Reformation, is given in the article **NATIONAL EDUCATION**, **SYSTEMS OF**. Special phases of the educational systems are discussed under **AGRICULTURAL EDUCATION**; **CHAUTAUQUA**; **COLLEGE**; **COLLEGES, AMERICAN**; **COMMON SCHOOLS**; **CURRICULUM**; **EDUCATION, COMMERCIAL**; **EVENING SCHOOLS**; **GRAMMAR SCHOOLS**; **HIGH SCHOOLS**; **GYMNASIA AND REALGYMNASIA**; **INDUSTRIAL SCHOOLS**; **INFANT SCHOOL**; **MONITORIAL SYSTEM**; **MONTESORI METHOD**; **NORMAL SCHOOL**; **PROFESSIONAL EDUCATION**; **REALSCHULEN**; **TECHNICAL EDUCATION**; **UNIVERSITY**; **UNIVERSITY EXTENSION**. The more important present educational tendencies and problems are considered under the topics **COEDUCATION**; **COLLEGIATE EDUCATION FOR WOMEN**; **COLLEGES, AMERICAN**; **EDUCATION, COMMERCIAL**; **CURRICULUM**; **ELECTIVE COURSES**; **GRAMMAR SCHOOLS**; **KINDERGARTEN**; **MANUAL TRAINING**; **OBJECT TEACHING**; **NORMAL SCHOOL**; **PARISH SCHOOL**; **PEDAGOGY**; **SCHOOLS**. Certain aspects of these topics are also treated in the articles relating to the special universities, colleges and public schools, and in the sections on education in the articles **BELGIUM**, **FRANCE**, **GERMANY**, **GREAT BRITAIN**, **ETC.**

**Types of Education.** The definitions given above indicate that education has two phases, more or less distinct. First, it is the physical and psychical development of the individual, solely with reference to these activities within themselves; and, second, it is the process of adjusting the human being to his social environment—to the ideals and customary practices of his fellows. So far as the process is concerned, these two phases are not distinguishable, but are rather complementary; whereas, in reference to the conception and the realized purpose, they are clearly differentiated and often are in conflict. Its history presents many aspects that find a common explanation in the varying emphasis placed upon the individual and social phases, together with the relative importance which the activities for supplying food, clothing, and shelter assume at any given stage of culture. Among primitive people education was largely practical and centred in the family group. It was essentially a training given the child, ordinarily by his parents, in the customary processes of supplying the needs of food, clothing, and shelter. (Consult Letourneau, *L'Évolution de l'éducation dans les diverses races humaines*, Paris, 1898, and Webster, *Primitive Secret Societies*, New York, 1908.) These activities necessitated a variety of ceremonial observances relating to every interest in life in order to secure proper adjustment to the spirit world, omnipresent to the savage and the barbarian. As a priesthood developed, priests had instruction in the preservation and explanation of tradition and ceremonies, as distinct from the broader ceremonial education of all the people. Out of this esoteric training of the priesthood and the attempt to construct cosmographies grew in time philosophy, science, and literature, and the higher types of education. Such types are best illustrated by the Hindus, the Egyptians, and the Jews. There developed, too, along with these early types of priestly instruction, a caste system of education for the masses of the people, that gave, in addition to the religious ceremonial education mentioned, a training in the practical affairs

of life. In such a system the training was given by parent to child in the particular activities to which he had been confined in the growing division of labor. The caste system of education was highly developed by the Egyptians and the Hindus and, with the latter at least, has persisted until recent times. While the caste organization of society was never reached by the Jews, they did develop a system of industrial education akin to that of caste societies. The Chinese were the first of existing nations to develop a general system of literary education. While it does not of course affect all the people, it is at least open to all and does reach large sections of the population. It is essentially literary, dealing primarily with the sacred literature, organized as a preparation for the civil service, tested and controlled by a series of examinations. The successful competitors in these examinations become public officials, and the conduct of the government is thus placed in the hands of those who are by the very process of selection most opposed to innovations and to progress. This system, first organized in the time of Confucius, has undergone no radical change for the past 1000 years. The recent trouble with the Western nations incident to the Boxer uprisings has given opportunity for the influences gradually creeping in through contact with the Westerners to affect the examination system, and radical changes are now going on. The ancient Persians, the Greeks, and the Romans developed a national type of education which at first was largely military. But its political aspect expanded with Greek and Roman political life until individualism found expression in an education both liberal and practical. Since that time the process has been growing more scientific, synthesizing these several modes, influenced in a varying degree by the ideals of Christian religion.

**Historical Sketch of the Theory of Education.** The Greeks were the first to work out a theory and practice of education based upon scientific principles rather than upon religious beliefs and ecclesiastical ceremonies. The purpose of the early education, with both Athenian and Spartan, was preparation for the duties of citizenship, military, political, and religious. With the Athenians their activities provided for intellectual and æsthetic development, illustrated in the drama, religious ceremonial, the symposium, the choral performances, etc. From the middle of the seventh century B.C. there were at Athens elementary schools of a twofold character: one was the music school, which in time embraced instruction in reading and writing; the other was the school for gymnastics and dancing, which for earlier years was called the palaestra, and, for the period of adolescence, the gymnasium. The training in gymnastics was not a direct military training, but was aimed to produce a beautiful, symmetrical, agile, and sound body through various exercises, chiefly running, jumping, discus throwing, javelin casting, wrestling, and boxing. Nor were the music schools designed to produce performers; they were rather schools of expression. "Gymnastic for the body, music for the soul," was Plato's summary of the process of education, each in its way to produce harmony of development. In the fifth century B.C. intellectual education was much broadened by the Sophists, and much greater scope given to individualism. It became more largely a literary process, differen-

tiating into the rhetorical or oratorical and the philosophical education. Of the former, Socrates is the chief exponent; Socrates, Plato, and Aristotle are the chief exponents of the latter. In the *Republic* of Plato, which may be termed the first scientific treatise on the subject, elementary education consists of training in gymnastic and music, including letters; secondary, of the study of arithmetic, geometry, music, and astronomy; and higher, of dialectics, or philosophy. The elementary studies produced a harmony of body and soul that was the basis of all virtue; the secondary led to unity of thought; and the higher led to the contemplation of pure being, the union of truth and beauty. The purpose of this education was to obtain an insight into the essential nature of things. In this treatise, together with that contained in the *Laws*, there is found the fundamental distinction between the liberal and the practical education, between the different stages of education, and between the groups of study so long recognized under the terms *trivium* and *quadrivium*. It is indicative of the importance of education in Greek thought that, with Plato and Xenophon and Aristotle, it finds a place in the discussion of the science of government. Not only is education to be intrusted to the state, it is the state's most important function. However, in practice the philosophical influence on education but reinforced the tendency towards individualism; for the formation of the philosophical schools still further weakened the Greek commonwealth, instead of counteracting the dis-integrating influence of the Sophists, as was the aim of the theory.

The rhetorical education of the later Greek period is best represented by Isocrates. It is this type that is reproduced at Rome and best presented in Cicero's dialogue *On Oratory* and Quintilian's *Institutes of Oratory*. The early Roman education consisted of a training for the practical affairs of life, economic, military, and political, for which little or no literary instruction was necessary. The Laws of the Twelve Tables, with the biography and legends of historical characters, furnished all the subject matter of this stage, aside from the training given in practical duties. Under the influence of the Greeks a literary education was substituted, and with the early Empire there was developed an elaborate system consisting of an elementary school, the *ludus*, which had existed from early times, the grammar or secondary school, the rhetorical schools, and, in certain centres, as Rome, Constantinople, Marseilles, etc., a higher institution resembling the modern university. With the loss of liberty under the Empire, oratory lost its chief inspiration, and education became largely a process of formal training, in which even literature became a study of form. Though many of the emperors—among them Vespasian, Hadrian, and Antoninus—were patrons of education, learning ceased to have any profound influence on the character of society. Towards this formal intellectual life, represented in Greece by the philosophical schools, and in Rome by the rhetorical schools, the early Christian fathers were rather favorably inclined, notably Clement of Alexandria, Origen, and Basil; but later the attitude of the Christian teachers became distinctly hostile. Especially is this true of the Latin fathers, as represented by Tertullian and St. Augustine, the latter being responsible for the edict of the Council of

Carthage, which forbade the study of pagan literature by the bishops. The ascetic spirit was another cause of the opposition to learning and culture, since both were essentially worldly, and hence evil. Yet to monasticism (q.v.) is chiefly due the preservation of learning during the centuries known as the Dark Ages. The rules of St. Benedict provide for the copying of manuscripts and the reading or the hearing of the Scriptures as a part of the daily routine of monastic life. Yet during some centuries many monasteries existed in which no reading or writing could be done. On the other hand, the monasteries sheltered some at all ages who had an abiding interest in literature and learning. During the earlier centuries of the Middle Ages this was especially true of those monasteries that transmitted the Grecian influence. St. Basil, in opposition to the extreme asceticism of Egypt and the East, had introduced a more intellectual element into Grecian monasticism; this was carried by Cassianus to southern France, and from there by St. Patrick to Ireland. Celtic monasticism dominated the British Isles during the seventh and eighth centuries, and thence the intellectual interest was carried to France and the Continent by Alcuin in the eighth century, and by John Scotus Erigena in the ninth. Scotus marks the beginning of Scholasticism (q.v.), though the scholastic movement can hardly be said to have been general before the twelfth century, and it culminated in the thirteenth. Scholasticism was the first of the great intellectual revivals, unless the movement under Alcuin and Charlemagne can be considered a preliminary revival of interest in learning, organized now with the form if not the content of ancient times. (See ARTS, LIBERAL.) Scholasticism was distinctly an intellectual movement, beginning with the discussion of the Platonic and Aristotelian problems of the nature of ideas, and ending with the systematization of all thought in the form of a theological philosophy. However, the intellectual interest was clothed in a theological form, and partook of a logical rather than a rhetorical character; in fact, its exponents sought rather to avoid literary form for severe and precise statement. Out of the scholastic movement came the early universities, at least the one at Paris and its offshoots. In them intellectual interests were provided with a home, and education obtained that institutional foundation which had been wanting since the decline of Roman culture and government. This conception of the formal character of the subject matter of education and the disciplinary character of its method prevailed both within and without the universities until the Renaissance of the fifteenth and sixteenth centuries. At this time the world awoke to the fact that there were other interests in life besides the religious, and that there was a vast literature much more varied and complete than that upon which interest had been centred for many generations. Intellectual interests were stimulated, and the conception and purpose of education were broadened by the activities of such men as Petrarch; such teachers as Vittorino da Feltre, and finally by the teaching of the universities, though they had responded somewhat slowly to the new influences.

The Renaissance emphasis upon the linguistic character of education introduced new secular interests into the then prevalent system. In

early years instruction had to be of a religious character and hence centred in the religious literature, which demanded a knowledge of the Latin language. Higher instruction was, to a large extent preparation for controversial life in connection with religious doctrines and literature and hence had also to be linguistic in its elements. The Renaissance interest in the rudimentary sciences and in the æsthetic element in literature was almost wholly eliminated from organized educational efforts; while, in addition to this, the religious conflicts introduced by the Reformation movement so agitated and demoralized the social, domestic, and political conditions of the times, that organized education, subjected like all other institutions to the distressful storms of the period, suffered greatly in the general upheaval. Nevertheless, during this agitated sixteenth century there were educational influences at work, which crystallized into definite school organization and procedures, best typified by the work of Johannes Sturm (q.v.) and later by that of the Jesuits. Sturm, who was the head of the Strassburg Gymnasium from 1537 to 1582 and was inspired by the work of the Brethren of the Common Life, organized a ten years' course of study, consisting of Greek and Latin grammar, rhetoric, and literature. Not till late in his 45 years' experience did he introduce any study of mathematics into the last years of his curriculum. Sturm's ideas concerning organization and subject matter were most influential in shaping the developing school system of the German states. His course of study, slightly amplified, was adopted in the higher schools soon to become common under the term *gymnasium* (q.v.). His methods, embodied in textbooks, were perpetuated and popularized in a similar manner, not only in German states, but elsewhere. Through Roger Ascham, the tutor of Queen Elizabeth and the friend of Sturm, similar educational ideas and practices were adopted as a characteristic feature of the public or grammar schools then being founded to some extent in England. In the latter part of the sixteenth century the Jesuit Order formulated its *Ratio Studiorum* (q.v.), embodying many ideas similar to those of Sturm. Their numerous schools were the most efficient and popular up to the middle of the eighteenth century, by the end of which there were 612 colleges, 157 normal schools, and 24 universities. Sturm and the Jesuits only organized the humanistic educational ideas of the Renaissance; and the resulting education was in its content a wholly literary one of the extremely classical type, while its purpose and discipline were largely determined by religious influences. Sturm was a Ciceronian, and it was wholly with the purpose of producing the ability to use the Ciceronian Latin and of securing the discipline entailed by this process that the dominant educators of the sixteenth and seventeenth centuries labored. During this period there were not wanting, however, those who protested against this formal education and insisted that the purpose of the study of the classical literature was the possession of the knowledge contained therein and not yet to be found in any of the vernacular literatures. Erasmus, though a humanist, took this position; but the two Frenchmen Rabelais (q.v.) and Montaigne (q.v.) were the chief of these, while about the middle of the seventeenth century John Milton issued his *Tractate on Education*,

which demanded that the whole range of the sciences and arts should be studied in the Greek and Latin literature and propounded this notable definition of education, viz., "I call a complete and generous education that which fits a man to perform justly, skillfully, and magnanimously all the offices, both public and private, of peace and war." By Milton's time, however, there was abroad a new spirit in education, in which he participated to some extent. This was the same spirit that was represented in philosophy by Descartes and in science by Bacon; in education the great exemplar was Comenius (q.v.). The educational influence of Comenius was expressed (1) in broadening the conception of education beyond the narrow literary and linguistic confines until it included the whole realm of knowledge, as conceived in the popular pansophic philosophy of the time; (2) in organizing education into a definite institutional hierarchy and systematizing its subject matter into a definite course of study, which included the elements of all the sciences, both natural and social; (3) in introducing improved methods of instruction based on conceptions—more or less erroneous, it is true—of natural processes. These ideas were embodied in a series of textbooks, the most important of which was the *Orbis Pictus* (q.v.). Comenius was not alone, even in the educational field, in standing for these new ideas. Ratichius (q.v.), or Ratke, had preceded him, but had exerted little influence, owing rather to his temperamental defects than to the novelty of his ideas. Even in the preceding century Rabelais and Montaigne had led in the criticism of the prevailing educational ideas and practices, and while they had little influence on school work or little knowledge of the technique of the educational process, both opposed the extreme classicism of the time, protested against the acceptance of erudition as the aim of education, of the formal linguistic discipline as the purpose of the study of the classical literature, and held even more broadly that experience in life gave the purpose to education, so far as it was a definitely organized process. Rabelais and Montaigne were significant rather as protestants, giving an embryonic formulation to a conception of education to be further developed and made practical by such men as Comenius. The practical aspect of the Comenian movement was limited to the seventeenth century, though the line of thought was continued. In 1693 John Locke published his *Thoughts Concerning Education*, which continued the general thought of Comenius, though without recognizing the importance of a scientific rather than linguistic curriculum, as might have been expected. This work of Locke has probably been of wider influence than any other treatise on education written in the English language, unless it be Herbert Spencer's *Education*. Locke emphasized the moral and physical aspects of education, in these respects exerting a profound and lasting impression on English education, both under the tutorial system which he approved and in the public schools. He had in mind the education of an English country gentleman of his time and gave little attention to the philosophical aspect of his education. This is treated in the more general work on *The Human Understanding*, and its influence passed through the writings of the empirical school of philosophy until it reached Rousseau. Jean Jacques Rousseau (q.v.) is the most com-

manding educational figure in the eighteenth century. In 1762 appeared his *Emile*, which was destined to direct the current of educational thought for a century. His dominant thought was "education according to nature," a shibboleth which had a variety of interpretations; it meant, primarily, that the influence of human society is evil, that education should seek to eliminate all social influence, that education should shield the mind from error and the heart from evil, and this largely by isolating the child; it meant, further, that the "nature" to be considered in education was the nature of the child, not nature in the Comenian and Baconian sense of the general processes and phenomena of the physical and biological worlds, and this is its most important educational meaning; but it also meant nature in this latter sense as well, the world of things, since it was only the education that came from things that was wholly good. This last interpretation of the naturalistic doctrine led to the complete rejection of literary and linguistic education, and in time to the organization, for elementary education, of a curriculum more suited to the needs of the child, drawn from those phases of his environment with which it came into immediate contact, such as geography, nature study, number work, and manual occupations. While Rousseau's ideas were most radical and were often stated in such paradoxical form that they provoke dissent and violent opposition, he more than all others is responsible for these fundamental conceptions of modern education: that all educational processes must start from the child's own interests and activities; that education is a process having several distinct stages, and that the subject matter and methods of education should be appropriate to each stage; that the age of adolescence is the vital period in education; that education is moral, physical, and social rather than a merely intellectual process; that knowledge of child nature in general and of the children dealt with in particular is the most important part of the equipment of a teacher; that manual labor or trades should be taught for their educational as well as for their moral and practical value.

The exaggerated, somewhat visionary, and often erroneous ideas of Rousseau were systematized and made practical during the latter part of the eighteenth century and first half of the nineteenth by groups of educators led by such men as Pestalozzi (q.v.), Herbart (q.v.), and Fröbel (q.v.). There is a wide divergence in the interests and the character of the work of these various groups, but they agree in one fundamental principle, which characterizes and unifies all their efforts and all this period of educational advance. This principle is that the "nature" which is to control education is the nature of the child. Pestalozzi states the aim of the entire group when he says that his whole purpose is to "psychologize education." Pestalozzi's approach was empirical, and his efforts were wholly practical. Herbart's approach was both philosophical and scientific, though it is in this latter aspect that his influence has been permanent, through the development of the scientific study of psychological phenomena of late, in its experimental and physiological aspects. Fröbel's approach was primarily philosophical through the connection of the theory of evolution with education, as seen in his *Education of Man and Education by Development*.



However, his great influence was on the practical side, and it is for the application of these new theories of education to the first few years of the child's life by means of a new educational institution, the kindergarten (q.v.), that the name of Fröbel will always stand. But whether this conception of education was stated in philosophical or even metaphysical terms, as with Kant, Herbart, and others, or in practical or empirical terms and concrete methods, the underlying conception and the general influence were the same. The psychological tendency in education was based upon a more intimate knowledge of child nature and a study of child activities; it was characterized by a broader sympathy with childhood and child nature; it turned attention from the advanced phases of education and centred it upon the elementary stage; it tended to break down the bookish character of education and substituted the objective side of the child's immediate environment (see OBJECT TEACHING); it furnished a great stimulus to the movement for universal education; it concentrated educational interests in the problems of method, both psychological and practical. The beliefs of many, especially of those under the influence of Pestalozzi, were extreme in this respect. Pestalozzi's thought was that any mother, with the methods which he had formulated, could, despite no special training or knowledge, educate her own children without the assistance of books or any of the usual paraphernalia of the schoolroom. This is extreme reaction from that conception of education, dominant since the Renaissance, in which education was the acquisition of knowledge, especially linguistic and literary. Pestalozzi defined education to be "the harmonious development of all of the powers of the child," a definition which expresses the central thought of the entire psychological tendency—that education is the process of the development of the individual.

During the second and third quarters of the nineteenth century the reaction against the extreme individualism of the earlier period affected educational thought as well. In contradistinction to the psychological, this may be termed the sociological conception of education and emphasizes the thought that education is not only the development of the individual, but that it is also the fitting of the individual to his social environment, actual and idealized, and hence that it is the development of society as well as of the individual. Auguste Comte in his *Positive Polity* (1851-54) and Herbert Spencer in his *Education* (1861) may be taken as the leaders in this movement, though Pestalozzi in his *Leonard and Gertrude*, published from 1780 to 1790, also emphasized this aspect of education. This sociological interest has centred in two points: (1) in a broader educational purpose than that expressed in psychological terms, and in this it has but put into educational terms the developing ethical, political, and social thought of the nineteenth century; (2) in a revision of the school curriculum, through the introduction of new subjects, chiefly of a scientific character, and in a modification of emphasis and organization. In its earlier stages the movement was largely a result of the expansion of the organized branches of human knowledge and the demand made by the new professional and industrial opportunities for a wider knowledge and a training different

from that afforded by the old literary education. The change in the curriculum of the colleges as well as of elementary schools; the rapid development of institutions of the type of American high or secondary schools, of technical, manual-training, and professional schools; the introduction of the system of elective courses (q.v.) into colleges; the important position given to the various natural and social sciences; the attention devoted to the organization of all the school curricula and the school systems—are all aspects of the sociological tendency, the influence of which is leaving its impress on the educational systems throughout the world, many of which have been reorganized within the last ten years to meet the changing social demands and the consequent changing conceptions of education.

**Education as a Science.** Not to be clearly distinguished from this sociological tendency is a more comprehensive view of the past decade, which has aimed to combine the essential truths of the above tendencies and hence may be called the eclectic or scientific view. It recognizes the coördinate value of method and subject matter, of the process of the development of the mind, and of the relation of educational activities to society. It avoids the controversial character of the parent tendencies and aims rather at scientific exposition. It is based upon the results of both psychological and sociological sciences and has influenced education rather through the more scientific formulation of the principles of method and curriculum in their mutual relations. The following definitions set forth this conception: Education is "the organization of acquired habits of action and tendencies to behavior which shall fit him [the child] to his social and physical world"; it is the "making over of experience and giving it a more sociological value through increased individual efficiency or better control over one's own powers"; it is "the adjustment of the child to the spiritual inheritance of the race." These three definitions, given respectively by the late Prof. William James of Harvard, Prof. John Dewey and President Butler of Columbia University, give the idea of the foremost leaders in educational thought in the United States at the present time. The study of education is now recognized as a science in that it has a body of data quite as definite as that of many of the applied sciences and as well-defined methods of dealing with such data. It is not a science in the sense of having any universally accepted group of principles as a basis of study, and in this it is in the same status as history, sociology, and most of the social sciences. Its recognition as a science has led to the establishment in most of the leading universities of departments of education of a character wholly different from that of the professional training normal schools (q.v.). Of the last importance is the influence exerted by the Government Commissioner through the Bureau of Education at Washington. Dr. W. T. Harris, by his official publications, private editorial work, and public addresses, assumed the leadership originally contemplated in the establishment of the department, and this position has been further developed by his successors. As a result of this professional and scientific study of the subject, the character of the teaching profession has been greatly improved, and more intelligent consideration has been given by the public to

the problems of local school organization, supervision, textbooks, methods, and the relations of teachers, as well as to the broader subject of education as a matter of public policy.

**Bibliography.** There is no more conclusive evidence of the importance and the scientific character that the study of education assumed during the nineteenth, and continues to hold in the present, century than the very extensive literature of the subject. A very few titles selected from this extensive list may be here mentioned. Hall (Boston, 1893), Sonnenschein (New York, 1891 and 1895), Monroe (New York, 1897), Cubberly (New York, 1902), have each published a *Bibliography of Education*. *The Bulletin of the Books on Education in the Libraries of Columbia University* (New York, 1901; new ed., 1911) also furnishes an extensive bibliography. Since 1910 there has been issued in 5 vols. a *Cyclopædia of Education*, ed. by Paul Monroe, which supplies a gap in this field in English and may fitly be compared with Buisson's *Dictionnaire de pédagogie* (Paris, 1887; 2d ed., 1903-11), or Rein, *Encyklopädisches Handbuch der Pädagogik*, or Schmid, *Encyklopädie des gesamten Erziehungs- und Unterrichtswesens* (10 vols., Gotha, 1886-87). Sonnenschein has published a brief *Cyclopædia of Education* (London, 1889). Other works which, while not equal in scope to the cyclopædias mentioned, are fairly comprehensive in character, are: Barnard, *American Journal of Education* (Hartford, 1855-81); Appleton, *International Education Series* (45 vols., New York, 1885 et seq.); Heath, *Pedagogical Library* (28 vols., Boston, 1886 et seq.); Scribner, *Great Educator Series* (10 vols., New York, 1892 et seq.); and the *Reports of the United States Commissioner of Education* (Washington, 1867 et seq.); *Special Reports on Educational Subjects*, issued by the English Board of Education since 1896-97. Several universities also issue works on different phases of education, among which may be mentioned the *Teachers College, Columbia University, Contributions to Education*, now containing nearly 60 vols. For the very numerous French and German works on the history of education, the reader is referred to the bibliographies given above. Among the best are those by Schmid, Schmidt, Raumer, Paulsen, and Grasberger. Raumer, *Geschichte der Pädagogik*, has been translated for the most part in Barnard, *German Teachers and Education* (Hartford, 1878). Compayré, *History of Pedagogy*, is published in translation by Payne (Boston, 1886). On ancient education the best English works are: Laurie, *Historical Survey of Pre-Christian Education* (London, 1895); Monroe, *Source Book in the History of Education for the Greek and Roman Period* (New York, 1901); Mahaffy, *Old Greek Education* (ib., 1882); Davidson, *Education of the Greek People* (ib., 1894); Freeman, *Schools of Hellas* (London, 1909); Wilkins, *Roman Education* (Cambridge, 1905). For general histories of education, consult Monroe, *History of Education* (New York, 1911); Graves, *History of Education* (3 vols., ib., 1909-13). On modern education a few of the best historical and descriptive works are the *Reports*, by Matthew Arnold (London, 1861 et seq.); the publications of Henry Barnard on *National Education* (New York, 1857-73); the volumes in the general series referred to above; Russell, *German Higher Schools* (ib., 1899); Balfour, *Educational Sys-*

*tems of Great Britain and Ireland* (London, 1912); Quick, *Educational Reformers* (New York, 1890). In addition to the treatment given in the above references, the works of the following authors relate wholly or in part to theory of education: viz., Plato, Aristotle, Cicero, Quintilian, Plutarch (the discussions on education by these writers are given in selections in Monroe's *Source Book*, mentioned above), Comenius, Rabelais, Montaigne, Milton, Locke, Rousseau, Pestalozzi, Fröbel, Richter, Rosmini, and Spencer. For statement of present formulation of theory, consult: Harris, *Psychologic Foundations of Education* (New York, 1898); Butler, *The Meaning of Education* (ib., 1898); James, *Talks to Teachers* (ib., 1899); Dewey, *The School and Society* (Chicago, 1899); *Ethical Principles Underlying Education* (Ann Arbor, 1894); Butler, *Education in the U. S.* (Albany, 1900). See, in addition to the titles referred to in the first paragraph of this article, ACADEMY; DEGREE; MILITARY EDUCATION (and articles on the various schools); MONASTICISM; POLYTECHNIQUE; REFORMATORIES; SCHOOLS OF LIBRARY ECONOMY; and the articles on the various colleges and universities.

**EDUCATION, COLONIAL.** A term used to indicate educational systems and practices in colonial dependencies. There is no special type either of ideas or of systems that can be indicated by this term, which consequently is used in a most general sense. However, of recent years it has become a very important phase of educational activity, since the various colonizing nations have established systems of schools as a valuable means in governing colonies and in making dependent peoples into closer sympathizers with the home nation, or at least have accepted educational endeavor as a means of raising the standard of civilization of subject races. Previous to the Revolution of 1776, colonizing governments took little or no direct interest in education, and such efforts as were made were wholly those of the colonists themselves or of individuals and religious bodies at home. Such efforts naturally resulted in direct imitation of institutions existing in the parent country and find their best illustration in the American colonies of England previous to the Revolution of 1776. Here the elementary or dame school, the secondary or grammar school (q.v.), and the college were English institutions transferred to American soil, and it was not until well into the eighteenth century that these English institutions were so modified that they became schools, known as the district school, the academy, and the American college. Of these the college was most distinctly American from the first and hence underwent the least change. Naturally, at the present time, the character of education, in the colonies of any nation or in any particular colony of a given nation, is determined by the general character of the colonial government. The colonies of Great Britain, as being the furthest developed and most systematized, best present the various types. In self-governing colonies, those possessing responsible governments, the educational system is wholly under the control of the colonial government and is only to a slight extent an imitation of the English institutions. Hence the educational systems of the Australian and Canadian provinces do not differ in the character of their origin or of their control from those of the States of the American Union.

There is, it is true, a higher degree of central control in all of these than in the systems of American commonwealths, but this is in no wise connected with the home government in London. In the second class of colonies, those that possess some representative institutions, but in which the public offices are controlled by the home government, the most important educational institutions are for the most part transplanted English institutions, modified in non-essentials to suit local conditions, supported from colonial revenues, and controlled by the home-appointed colonial officials. Profiting by earlier experiments, especially in India, more regard is now had for existing educational institutions, practices, and prejudices. Native institutions are fostered, and there usually exist the two types of schools—the English schools and the vernacular ones, the former being for the most part secondary and higher schools, to which greater attention is given. India furnishes a good illustration of this. In 1911 there were enrolled in public elementary schools 4,625,890 pupils, or 2 per cent of the population, while only 899,588 were enrolled in public secondary schools and 31,447 were enrolled as students in colleges. In the crown colonies, those wholly under the control of the home government, a somewhat similar condition exists. English schools are established, native schools are assisted, and numerous private, especially missionary, schools are found. As in the previous class of colonies, greater attention is paid by the authorities to the English school than to the native, and consequently to secondary and higher education than to elementary. This condition, which is now being reversed, has resulted from the fact that the elementary schools have been begun largely by missionary or native effort, and the government has followed the home policy of assisting them to some extent; while secondary and higher efforts have awaited the direct initiative and support of the government. In 1901 the Board of Education of the British government presented a special report of almost 2000 printed pages, giving a detailed account of education in the more important colonies. Greater interest is being shown in Imperial education as a result of the Imperial conferences of 1907 and 1911. Such conferences are to take place quadrennially, and it is proposed to establish an Imperial bureau of education to publish information on different aspects of education throughout the Empire.

The French government supports schools in most of its colonial dependencies, though none of the colonies are self-supporting, few have any extensive European population, and most of them are sparsely settled or are peopled by distinctly inferior races. Algeria is excluded from this statement, since no distinction is made in education between it and the other departments of France in Europe. So far as possible, the French system of schools is extended to the colonies, and in recent years the anticlerical movement of the mother country has helped to oust the educational work of the religious teaching orders; but on account of the conditions mentioned above there is little demand for secondary or higher education, save of a technical or professional character, and consequently most attention is paid to elementary schools. In French India, Indo-China, Annam, Cochin-China, Tonkin, Madagascar, Congo, Mayotto, Réunion, Sénégal, Guinea, and the islands of

both the East and the West Indies, schools are maintained of both primary and secondary type. These secondary schools are usually normal or agricultural schools, infrequently the French Lycées. The schools are supported from local funds in most cases, but the French government also makes an annual subsidy.

The colonies of the German Empire have all been acquired since 1884, are sparsely settled, usually by distinctly inferior races, and are for the most part in the tropics. Hence the possibility of influencing the state of civilization by schools is slight. Besides missionary schools, the government supported in 1909 two schools at Togoland, four in Kamerun, a system of 40 or 50 schools in East Africa, and 11 schools in southwest Africa. The German government has adopted elaborate educational measures in its Chinese protectorate, and two departments have been established at Tsingtau—a preparatory school with a six-year course and receiving Chinese boys over 13 years of age, and a school of science with (1) a department of law and political science and (2) a technical department. Such schools as exist in the German possessions among the Pacific islands are maintained with a few exceptions by missionaries, both Protestant and Roman Catholic.

No other country has seen the importance of education as a means of colonial rule so clearly as the United States. Hence, in the short time during which the government has held the colonies, great progress has been made. This progress is here presented in detail.

**Hawaii.** When the United States Government assumed control in 1898, there was less to do in regard to educational conditions than in any of the other recently acquired island territory, and less to do in regard to education than in almost any other aspect of Hawaiian conditions. In fact, the educational status of Hawaii is better, as regards illiteracy and school attendance, than that of many States of the Union. The existing government, then, has simply continued the established system and maintained its high standard. This exceptional condition, however, is largely due to the influence of Americans exerted over a long period. By the earliest missionaries in 1820 the natives were taught the alphabet, and many of them learned to read English before their own language was reduced to a written form. Within four years 2000 people had learned to read, a system of public schools had extended over the islands, and so great was the early enthusiasm that a large part of the population was in attendance. A seminary for the training of teachers, which still exists, was established in 1831; in 1833 the Oahu Charity High School, which has since become the Honolulu High School, was founded, followed in 1836 by a boarding school for boys and in 1839 by an industrial training school. The Royal School for chiefs, founded in 1840, and since become a school for all Hawaiian boys, was the chief school for the teaching of English. Numerous other mission schools sprang up from time to time, and in 1839 the Roman Catholic missionaries established a system of schools. The first comprehensive system of laws was published in 1840, and these laws include a number of educational provisions. Most important of all was a compulsory-attendance law, with penalties for both parents and children for noncompliance, while it was further stipulated that no illiterate man or woman should "hold

office over any other man," nor could any illiterate person marry. In 1843 a department of public instruction was established with a minister of public instruction at the head, the first incumbent being the Hon. W. Richards, who was succeeded in 1847 by Rev. Richard Armstrong, father of Gen. S. C. Armstrong, of the Hampton Institute. In 1855 a board of education was substituted for the Minister of Education. In 1896 the system was again reorganized and placed under a minister and a board of commissioners, the Minister of Foreign Affairs being Minister of Public Instruction ex officio. Under the present scheme a board of six commissioners with a territorial superintendent of instruction has charge of education. A traveling normal inspector has the supervision of each of the three inspection districts of the island. The use of English has become all but universal, so that now more than 98 per cent of those attending school are instructed in English. All public schools were made free in 1888, since which time such schools have increased their attendance at the expense of the private schools until at present they educate more than two-thirds of the population. Owing to the decrease in native population, the absolute number of Hawaiian children in the schools has decreased one-half in the last 50 years. In 1913 there were attending public and private schools in the territory 32,938 pupils (25,631 public and 7307 private), divided as follows: Americans, 1239; British, 153; Germans, 270; Portuguese, 5497; Spanish, 678; Japanese, 10,990; Chinese, 3783; other foreigners, 1769; Hawaiians, 4290; part Hawaiians, 4146. The total number of public schools was 161 and of private 51, the total population in 1910 being 191,909. Of the 974 teachers (734 female and 240 male) 89 were Hawaiian, 191 part Hawaiian, 457 American, and the remainder of various nationalities. According to the report for 1911-12, the government expenditure for popular education was \$722,912.57, of which \$92,577.92 was for new buildings. The cost per pupil was \$30.43.

In addition to the elementary schools there are also maintained a territorial normal school at Honolulu, a high school at Hilo, and the Hawaii College of Agriculture and Mechanical Arts, established in 1907. The United States Department of Agriculture maintains an agricultural experimental station in Honolulu.

**The Philippine Islands.** At the time of the American occupation there was a Spanish law requiring two school-teachers for every 5000 of population, though in reality there were at the opening of hostilities between the Spaniards and Americans only half that number. In 1897 the Spanish statistics showed 2167 public schools for about 6,000,000 population. Education was almost wholly under the supervision of the religious teaching orders, especially the Jesuits, and schools were held either in church property or in the house of the teacher. The public-school system, which had been established by the Spanish government in 1863, was widely diffused throughout the archipelago when the Americans arrived. The course of instruction consisted of Christian doctrine, reading, writing, arithmetic, Spanish, geography, Spanish history, practical agriculture, the rules of deportment, and vocal music. The percentage of natives who could read and write varied greatly in different localities, in some instances being high and in others low. There existed a class of

the native population that was highly educated and very intelligent. The University of Manila had an attendance of more than 1000 in 1896, and in the period from 1800 to 1882 had graduated 2392 students. In the public colleges or secondary schools of the island there was a total attendance of 8070 in 1896, and in addition 1915 in 67 private Latin schools. During the first two years of American control of the islands little attention was paid to education, but on March 30, 1900, a department of education was established under charge of Capt. Albert Todd. For five months the schools thus remained under military control. Whenever practicable, soldiers were detailed to assist in giving instruction in English, books and supplies were furnished, and efforts were put forth to continue the native schools after the Spanish system. Little, however, was or could be accomplished. On Sept. 1, 1900, Dr. Fred W. Atkinson assumed office as the first General Superintendent of Public Instruction for the Philippine Islands. The Philippine Commission adopted a general plan for education recommended by the Superintendent, which became a law Jan. 21, 1901.

This law established a department of public instruction that should have control over all schools of public or semipublic nature. It provided for an executive head of the department, with an annual salary of \$6000; for 18 division superintendents of schools at salaries of from \$2000 to \$2500 per annum; for 1000 teachers of English from the United States, at salaries of from \$900 to \$1500; and for the establishment and maintenance of normal, agricultural, and manual-training schools. A general appropriation of \$100,000 for the first year was made for the construction and equipment of buildings, and of \$220,000 for the purchase of textbooks and school supplies. The law established a municipal council of four to six members, who should have duties corresponding to those of local school boards in the United States; and also a superior advisory board of education, to be composed of the General Superintendent of Public Instruction as president and four members to be appointed by the Philippine Commission. The duties of this board are largely of an advisory nature, but investigations are to be conducted by them and recommendations made to the Commission. The system is highly centralized in the hands of the Director of Education (formerly the General Superintendent), who is responsible to the Secretary of Public Instruction. The provinces are divided into 400 districts, each under an American supervisor. The opening of new schools, the selection of textbooks, the approval of building plans, and the course of study are all subject to the control of the Director.

The system of schools as now organized includes free elementary schools throughout the islands; free high schools in almost all of the 40 or more provinces; a normal, trade, and agricultural school in the northern, central, and southern portion of the archipelago; a higher school of commerce, and a school for the deaf and blind at Manila; and, finally, the University of the Philippines, established in 1908 and, with the exception of the College of Agriculture at Los Baños, located at Manila. The plan of administration of the elementary school calls for a ten-months school year, with four hours of instruction daily, and one hour's normal instruction for the native teachers. In addition,

during each summer vacation a four-weeks normal session for the native teachers is held in each provincial capital, under direction of the American teachers, and vacation assemblies are held at Manila and other important centres. In the summer and fall of 1901 almost 1000 American teachers arrived and were assigned work throughout the islands in places determined by local needs and safety, while at the same time more than 120 of the former soldier teachers were retained. The body of teachers is recruited each year by the addition of nearly 100 new teachers from America. A vacation assembly for American teachers has been held annually since 1908 at Baguio. During the first year more than 100,000 pupils and 5000 Filipino teachers were enrolled in the day schools, and 20,000 adults received instruction in the evening schools. In 1911-12 the educational statistics were as follows: 3647 elementary schools with an average monthly enrollment for the year of 391,476 pupils; 38 high schools with 3599 pupils; 200 municipal manual-training shops; 35 provincial trade and manual-training schools; 664 American and 7696 Filipino teachers were engaged under 444 supervising teachers, 40 division supervisors, 2 assistant directors and 1 director of education. In the elementary schools much attention is given to industrial training, especially in the native industries, and valuable work is being done by the introduction of gardening. In all types of schools athletics play an important part as a civilizing influence to which the natives readily adapt themselves. The University of the Philippines consists of the following colleges: Medicine, Liberal Arts, Veterinary Science, Law, Engineering, and Fine Arts at Manila, and the College of Agriculture at Los Baños. Except for the School of Fine Arts candidates for entrance must be graduates of secondary schools. The six colleges were attended in 1911-12 by 599 students and the School of Fine Arts by 801 students. A college of education is to be added. The expenditure for schools during 1911-12 was \$3,176,617.04. Instruction was given wholly in English and from English texts. Many improvements in administration have been made, such as better grading of pupils, individual in place of concert recitation, the establishment of silent study for the old custom of studying aloud, and especially the change wrought in hygienic conditions. However, the chief work of the American administration of schools is to bring about a better spirit between the two peoples; and this is being done by the establishment of friendly relations between the American and the Filipino teachers, pupils, and parents. At least the mistake made by England in India, of concentrating efforts on higher education, is being avoided, and all efforts are centred in reaching the masses through the common school.

**Porto Rico.** The educational conditions in Porto Rico constituted one of the most serious elements in the situation which the Americans had to face on the assumption of control in the island in 1898. Excellent legal provisions for schools, including free tuition and compulsory attendance, had existed for many years, but for the most part these provisions had been dead letters. The excellent reforms in education introduced by the Spaniards in 1880 had been non-effective, and political and social conditions forbade any progress and prevented any interest

in such affairs. These conditions had been made much more critical at the time of the American occupation by the social and governmental disorganization incident to the war, and by the hurricane, which had destroyed most of the little interest the people had in schools, along with all ability to contribute to their support. Moreover, such interest as the people had had for generations was in the education of the upper classes and consequently in higher and secondary rather than elementary education. A few institutions of this higher grade existed, the most important of which were a collegiate institute, founded in 1880, with an attendance of 60; a normal school for girls, with an attendance of 50; and an industrial school for instruction in trade, with an attendance of 312. The methods of instruction and the management of the institute and normal, however, were so defective that after investigation these institutions were suspended by the American authorities, and other provisions made for carrying on such work. There were at that time, and still exist, a number of private colleges and academies, which for the most part are under religious control. One of these private institutions, *La Sociedad Protectora de la Inteligencia*, has for its object the sending of poor young men who have distinguished themselves in the examinations to the United States or Spain to complete their studies. The last Spanish statistics, three months before the Americans took possession, showed a total of 555 schools, all but 26 of which were public. Of these 380 were for boys and 148 for girls. The total enrollment in public schools was 25,644, with an attendance of 18,243. The attendance in private schools was 980. This was out of a population of almost 900,000, of whom 300,000 were of school age. The entire population showed by the American census an illiteracy of 83 per cent.

In May, 1899, six months after the Americans assumed control, Gen. John Eaton, formerly Commissioner of Education for the United States, was appointed Director of Public Instruction, and an order was issued by the military government for the reorganization of the entire system. An insular board of education of five members was created, the president of which was to be insular superintendent of education. The order divided the island into school districts, somewhat like those in the United States, provided English supervisorships, prescribed the manner of electing local school boards, established fines for nonattendance to duty on the part of the boards, and provided for district school taxes and the issuance of bonds. The municipalities were required to furnish buildings or quarters for the schools, distinct from the residences of the teachers. The schools were graded, a six years' course of study prescribed, the qualification of teachers defined and their salaries fixed, free textbooks provided for, and a high school, a normal school, and a professional school organized. Coeducation was not required, but was encouraged; and in the country districts where no provisions existed for the education of girls, it was provided that, upon request of parents, girls should be admitted.

While the law met with no opposition so far as internal administration was concerned, to a great extent it proved inoperative; for there was little or no response on the part of the local committees, and out of 800 towns of the

island, fewer than 20 made any attempt to effect a local school organization. Nevertheless, as a result of the action of the military authorities, within five months there were more schools in operation than ever before, and a larger proportion of the school population receiving instruction. In June, 1897, there were 212 town schools and 313 country district schools in operation, with 426 country districts yet unprovided for. But out of a school population of 297,812 only 29,172 were enrolled, and 21,873 in actual attendance, leaving more than 268,000 without school facilities. At the close of the following school year, however, the number of schools had risen to 800, of which 409 were in rural districts. These schools accommodated 9000 additional pupils. The general government also supplied all textbooks free of expense to pupils and local boards. More than 100 American teachers were employed in the schools, and half that many native teachers were sent to the United States for the purpose of acquiring the language and some training in practical instruction. Training and industrial schools have been established in the three most important cities. At present education is administered by a commissioner of education and an assistant commissioner; the island is divided into 43 supervisory districts, each under a supervising principal. In 1912-13 the number of different pupils enrolled in the common schools was 145,427 and in the secondary schools 1547. The number of teachers employed in the common schools was 1855 and in secondary schools 83. The total expenditure for school purposes in 1911-12 was \$1,366,810; the amount appropriated for education in 1912-13, \$1,902,712. The use of English as the medium of instruction is making rapid progress, especially in the graded schools. Much attention is given to the teaching of agriculture in the common schools, while manual work, sewing, and cooking are being more and more introduced.

The University of Porto Rico was established in 1903 and consists of the Normal School at Río Pedres, the College of Agriculture at Mayaguez, neither of which is of college standing, and a college of liberal arts, organized in 1910 and requiring the entrance qualifications set down by the College Entrance Board of the United States.

The greatest difficulty is the question of financial support. The military authorities raised the proportion of the public expenditures devoted to education from 6 to 12 per cent, but if the entire general revenue of the island had been appropriated for school work it would have been insufficient to offer instruction to all the illiterate youth of the land. Only very gradual improvement can be expected if no outside assistance is given to the island.

Cuba. The educational status of Cuba, at the time of the American intervention, was very similar to that of the other Spanish dependencies. There existed an excellent legal system, while the actual conditions were very deplorable. Such interest as existed was in reference to higher education, and admirable provisions were made for the more intelligent and wealthy classes. The University of Havana and a large number of secondary schools under private or religious control had been attended by large numbers of this class. The public schools were nominally free, but really depended on the tuition of pupils and consequently were patronized only by the well-to-do.

The system in force in 1899 was based on the Law of 1865 as modified by that of 1880. Every town of 500 inhabitants was required to support one elementary school for boys, and one, though incomplete, for girls; towns of 2000 inhabitants, two schools for boys and two for girls; and for every 2000 increase in population there was to be one additional school for each sex. This additional number was to include private schools, though at least one-third of all schools must be public. Secondary schools and kindergartens were provided for in cities of over 1000 population, and a normal school for the capital of each province. An admirable course of study was prescribed, but its actual administration and the textbooks used were under the inspection of the Catholic clergy. Attendance on either public or private schools was compulsory for all Spanish children from 6 to 9; the teachers in public schools were to be Spaniards. However, the municipalities had ceased, if they had ever done so, to pay any particular attention to these laws; no funds were voted, teachers were not paid, and their meagre revenue was drawn largely from tuition. The per cent of illiteracy under the American census taken in 1899 was 63.9 per cent. The latest Spanish school statistics were for the year 1893, two years previous to the outbreak of the last revolution. They show 35,000 children receiving instruction in the entire island in 898 schools. During the revolution most of these schools ceased to exist, if they had ever existed before. Those outside of provincial capitals and garrisoned towns were closed by order of the Governor-General. The autonomous government issued an edict reestablishing the schools in 1898, but their actual condition remained much as it was throughout the revolution at that time until a year after the American occupation, though there were said to be about 200 schools with 4000 pupils throughout the whole island.

On Dec. 6, 1899, the American Military Governor issued an order reorganizing the elementary and secondary school system of the island. It provided that there should be a board of education in each municipality, with the mayor as president, who should appoint the other members, and that there should be one public school for boys and one for girls in every town of 500 inhabitants, the number increasing with the size of the town. In smaller towns "incomplete" schools were to be established. It also provided for compulsory attendance, for the payment of tuition, for the inspection and superintendence, for free textbooks, and other details. The course of study was prescribed by the superintendent of schools. By March, 1900, there were 3099 schools, with 3500 teachers and 130,000 pupils. In the fall of 1901 there were 250,000 pupils, with almost 4000 teachers. Most of these children were in the first three grades, though a very small number were far enough advanced for the work of the fourth and fifth grades. This fact indicates the deficient conditions existing before 1900, for the age of the pupil is no indication of his stage of advancement.

One important phase of the American influence was the improvement of the teaching body. Summer normal schools were founded, which for two years furnished instruction to about 4000 teachers for a period of six weeks. During 1900 more than 1400 Cuban teachers attended the summer session of Harvard Uni-



versity, special provision having been made by that institution for their maintenance and instruction. Recognizing that permanent improvement must come from constant contact with more advanced sources outside the island, the Cuban government is now supporting 60 women teachers at the State Normal School at New Paltz, N. Y., with the understanding that these teachers are to continue their services in the public schools for a term of years upon their return. With a similar motive the Cuban Educational Society, receiving its support from many prominent public officials and business and professional men of the United States, maintains some 40 or 50 youths in American colleges, with the expectation that they will return to advance the educational interests of the island. In similar ways more than 1500 Cuban and Porto Rican boys are now being educated in the United States, all under obligation to return to their homes on completing their schooling. Another important phase of the work is the supply of school material and school buildings. There was not one building on the island at the American intervention that had been constructed for or was used for public school purposes. There was little or no school furniture, and the books were of the most antiquated character. The American administration devoted a great deal of effort and more than \$400,000 to secure inhabitable school buildings. More than 100,000 school desks and other appliances in proportion were purchased and distributed throughout the island. Textbooks of modern standards were prepared and published by order of the education department of the government and supplied for the first four grades throughout the island. The changes thus made have had a marked effect upon the illiteracy of the population; and an educational system, modern in spirit and method and almost universal in the opportunities it offers, was thus turned over to the Cuban people when they took charge of their own government.

Two conditions are apt to interfere to some extent with any great immediate development or even the maintenance of these standards. In the first place, all the American administrative functionaries, save one, have been withdrawn, and political influence is apt to interfere to some extent. In the second place, the American administration devoted a larger proportion of the revenues of the government than the native direction possibly can; and the necessities for school expenditures are apt to increase more rapidly than the general wealth of the island. The military order which introduced the American system has been adopted as a precedent, and its chief features have been embodied in a school law of 1909. New types of schools have been added; new subjects (manual training, physical exercises, lace work, sewing, drawing, etc.) have been introduced; and more attention has been given to the teaching of English, the training of teachers, and instruction in agriculture. In 1912 there were 3916 schools, taught by 4055 teachers; there were 234,625 pupils enrolled, with an average attendance of 105,774. The appropriations for 1909 were \$4,275,794. For the fuller treatment of the educational status of all these islands, consult *Report of the United States Commissioner of Education, 1898-99 and the following years*. Consult also *Special Report on Educational Subjects*, vols. iv and v, issued by the British Board of Education (Lon-

don, 1901). See CUBA; HAWAII; PHILIPPINES; PORTO RICO.

**EDUCATION, COMMERCIAL.** Recent experience and discussion are giving to commercial education a meaning as exact as are the terms "classical" and "technical" when applied to schemes of instruction. Confusion has arisen in dealing with this subject from the failure to distinguish between two different but perfectly legitimate senses in which the words are used. Commercial education may mean general education along modern lines, with a minimum of technical instruction, and, at the most, fairly preparing students for an apprenticeship in business pursuits. In another sense commercial schools are to the business world what preparatory trade schools are to the industrial world. Public commercial high schools, as they are being established in the United States, are, in the main, of this kind. Such training conforms to the European use of the term in that they give "a general education of such a nature as shall best fit youths for commercial pursuits." In another sense commercial education is applied to the training given in technical schools corresponding to trade schools or schools of technology. Such institutions give a maximum of technical instruction; they are made familiar by the American business college, but are further represented by higher schools and universities of commerce in both this country and Europe. The latter schools build at least on the general education of the secondary school. Higher commercial education has probably been best defined by the authorities of the London School of Economics and Political Science; it is that "which stands in the same relation to the life and calling of the manufacturer, the merchant, and other men of business as the medical schools of the universities to that of the physician—a system, that is, which provides a scientific training in the structure and organization of modern industry and commerce, and the general causes and criteria of prosperity."

**Commercial Education in Europe.** Germany may well be termed the home of commercial education. Special instruction along commercial lines was provided in Saxony in the eighteenth century. Well-organized commercial schools became a feature of German education in the nineteenth century; in 1898 a higher school of commerce was established at Leipzig—an example soon followed by other establishments in Cologne, Frankfurt, and Berlin. The Superior School of Commerce at Paris was founded in 1820 and continued to have a precarious existence under private management until 1869, when it was taken in charge by the Paris Chamber of Commerce. Commercial academies and schools have long been established in several other continental cities, among them being Vienna, Venice, and Antwerp. England has provided for higher commercial instruction at the London School of Economics and Political Science at the universities of Manchester, Liverpool, Leeds, Birmingham, and Belfast, while it has recently been proposed to make provision for the subject at Oxford. Both England and the continental countries have established schools that give commercial work of an elementary and rather technical character.

Commercial schools in Europe are of three types: 1. Higher, e.g. at Leipzig, Frankfurt, Cologne, Berlin, Paris, Lyons, Antwerp, Lon-

don, etc. Colleges and universities of commerce now being established in the United States correspond fairly to these schools. 2. Middle schools, academies, and the like, having usually a scheme of studies for three years, though some have four-year and others only two-year courses. These schools take students at about the ages at which they enter American high schools and give them an education more technical than is furnished in our high schools of commerce. 3. Some form of day or evening continuation school for those who are already serving apprenticeships in business pursuits. Chambers of commerce and other organizations of business men have in some cases assumed entire charge of commercial schools in Europe; in other cases the control has been by public or private authority alone; but a more common procedure is for business men to exercise some influence by serving on boards of control, supervising examinations, meeting deficits, etc. There are in addition, especially in Great Britain, numerous commercial and business colleges established as private ventures.

**Commercial Education in the United States.** The first clearly defined form of commercial instruction in America was that of the business colleges, which took their rise a little before the middle of the nineteenth century. Early in the eighties the Wharton School of Finance and Economy was established in the University of Pennsylvania (q.v.), and about the same time public high schools began to give work similar to that of the earlier business-college instruction. From this time the development of commercial education has been rapid. At present the universities of Pennsylvania and Wisconsin offer a full four-year college of commerce course, on the completion of which a baccalaureate degree is conferred. Since 1900 numerous other universities and colleges have established courses or departments for the scientific study of commerce. Among these may be mentioned Dartmouth (Amos Tuck School), New York University, the University of Chicago, the state universities of California, Illinois, and Michigan, Harvard University, the University of Vermont, and Tufts College. In some of these institutions the study of commerce forms part of the work of the college of liberal arts; in others a special four-year course, leading to a degree in commerce, is offered; while in others the subject is offered as a graduate professional course (Amos Tuck School at Dartmouth and the Harvard School of Business Administration). Some of these departments, e.g. Pennsylvania, have organized evening courses in commerce.

The growth of secondary schools of commerce has been more rapid than that of the colleges. Independent high schools devoted to commercial education are now in existence in New York, Chicago, Philadelphia, Washington, Pittsburgh, and other cities, while commercial departments and elective commercial studies are well-nigh universal in high schools of the country. The private business colleges are as well patronized as ever, and hundreds of thousands of young people are at present receiving a commercial education in the United States. Columbia University offers evening courses in commerce and finance, leading after three years to a certificate in commerce and preparing for the State examination for the certificate of Certified Public Accountant. It is also proposed to introduce

special courses in the College of the City of New York.

**Associations and Journals.** For nearly ten years the Business Education Section has been conducted as one of the departments of the National Education Association. Sessions are held annually in connection with National Association meetings, and the proceedings are printed in the association's report. Many other associations are active in this country, the best known of them being the National Federation of Commercial Teachers and the Eastern Commercial Teachers' Association. In England there is the Yorkshire Association for the Promotion of Commercial Education, and in Germany the Deutscher Verband für das kaufmännische Unterrichtswesen. Most important, perhaps, of all the societies is the International Association for the Advancement for Commercial Education. Among special journals are the *Zeitschrift für das gesamte kaufmännische Unterrichtswesen*, published by Teubner, in Leipzig, and the *Practical Educator*, published in Columbus, Ohio.

Consult: Olabae and Zogler, *Das kommerzielle Bildungswesen der europaischen und aussereuropaischen Staaten* (4 vols., Vienna, 1903-06); Zeiger, *Handelsschulgedanken im 18. Jahrhundert* (Dresden, 1900); Stegmann, *Kaufmännisches Fortbildungsschulwesen* (Brunswick, 1896); Léautey, *L'Enseignement commercial et les écoles de commerce en France et dans le monde entier* (Paris, Librairie comptable et administrative); James, *A Report on Education of Business Men in Europe* (1893); id., *Commercial Education in the United States* (Monographs on Education for Paris Exposition, Albany, N. Y., 1900); Hooper and Graham, *Commercial Education at Home and Abroad* (London and New York, 1901); Ware, *Educational Foundations of Trade and Industry* (New York, 1901); Sadler, *Higher Commercial Education at Antwerp, Leipzig, Paris, and Havre* (London, 1898; Special Reports on Education, vol. iii); id., *Recent Developments in Higher Commercial Education in Germany* (same series, vol. ix); Hartog, *Commercial Education in the United States* (same series, vol. xi); Herrick, *Meaning and Practice of Commercial Education* (New York, 1904); *Report of the Commission on Industrial and Technical Education* (Boston, 1906); Vanderlip, *Business and Education* (New York, 1906); American Association of Public Accountants, *Report of the Educational Committee Giving Information on the Department of Commerce, Accounts, and Finance of One Hundred of the Leading Universities of the United States* (Denver, 1912); F. E. Farrington, *Commercial Education in Germany* (New York, 1914).

**EDUCATION, COMMISSIONER OF.** The chief officer of the Bureau of Education, at Washington. He is appointed by the President and Senate, and his duties are "to collect such statistics and facts as shall show the condition and progress of education in the several States and Territories"; to diffuse such "information respecting the organization and management of schools and school systems and methods of teaching as shall aid the people in the maintenance of efficient school systems and otherwise promote the cause of education"; and also "to present annually to Congress a report embodying the result of his investigations and labors, together with a statement of such facts and recommendations as will, in his judgment,

subserve the purpose for which the department is established." The office was established in March, 1867. The incumbents have been Henry Barnard (1867-70), John Eaton (1870-86), Nathaniel H. R. Dawson (1886-89), William T. Harris (1889-1906), Elmer E. Brown (1906-11), Philander P. Claxton (1911- ).

**EDUCATION, COMPULSORY.** See **NATIONAL EDUCATION, SYSTEMS OF.**

**EDUCATION, MILITARY.** See **MILITARY EDUCATION.**

**EDUCATION, NATIONAL SYSTEMS OF.** See **NATIONAL EDUCATION, SYSTEMS OF.**

**EDUCATION ASSOCIATION, NATIONAL.** A society of teachers and educators organized as the National Teachers' Association at Philadelphia, Pa., in 1857, and incorporated under its present name in the District of Columbia in 1886. The aid which associated teachers might render to the progress of education was recognized in the United States early in the nineteenth century, and a number of such societies were formed, though of somewhat limited scope. Perhaps the best known of these, the American Institute of Instruction, organized in 1830, confined its work to New England; a similar society in the West, the Western College of Teachers, was organized in Ohio in 1831; the American Association for the Advancement of Education was founded at Philadelphia in 1849, and there were, besides, numerous State educational societies. In 1856, however, a call was issued by the presidents of 12 of the State societies for a general association of national extent to "advance the dignity, respectability, and usefulness" of the teaching profession and to develop educational science "by distributing among all the accumulated experiences of all." The society thus initiated grew slowly and did not gather large effectiveness until its work began to be specialized in 1870. In that year combination was made with the American Normal Association and the National Superintendents' Association, and departments were instituted of higher and elementary instruction. Other sections were then rapidly inaugurated, so that the association at present includes the National Council, an advisory body, and 19 departments devoted to the special problems of method, organization, and the courses of study in nearly every type and grade of educational work. At their annual meetings held in different parts of the country the society gives large space to specialized and concrete discussions in the several departments. These proceedings, together with those of the society as a whole, published in the *Annual Reports*, constitute the most important body of pedagogical literature in the country. In 1892 a committee of 10 was appointed to report upon the curricula of secondary schools. This report, insisting upon greater intensity and coherence in school work and upon the more intimate correlation of studies, exercised wide influence, and its conclusions were very generally adopted. Other reports exercising an influence hardly less wide were those of the committees on elementary schools (1895), on rural schools (1897), on college entrance requirements (1899), on normal schools (1899), on public libraries and public schools (1899), and on teachers' salaries (1913 and 1914). The active membership of the society is some 30,000, but the annual meetings are usually attended by more than that number, the larger proportion being associate members.

The meeting and exchange of opinions of teachers from all sections of the country has contributed largely towards unifying educational procedure and in developing an approximate even system of educational theory. Several of the leading educators of the country have taken an active interest in the association's welfare. Among these may be especially mentioned Nicholas Murray Butler (q.v.) and William T. Harris (q.v.). Consult: *History of the National Education Association of the United States* (Washington, D. C., 1892); the reports of the *Committee of Fifteen*, the *Committee of Teachers*, etc.; the *Proceedings of the Department of Superintendence of the National Council*; the annual volumes of the *Proceedings of the National Education Association* (Washington D. C.).

**EDWARD, or EADWARD** (?-924). A king of the English, known as the Elder. He was the son of Alfred the Great and was chosen by the witan to succeed his father, probably in October 901, having previously distinguished himself in the wars with the Danes. His cousin Ethelwold, who disputed Edward's right of succession, was killed in battle in 905. After 20 years of fighting Edward subdued the north as far as the Humber and was recognized as overlord by all the other kings in the island. Consult Green, *The Conquest of England* (London and New York, 1883); Hodgkin, *History of England, from the Earliest Times to the Norman Conquest* (London, 1906); Oman, *England before the Norman Conquest* (ib., 1910).

**EDWARD, or EADWARD** (c.963-978). A king of the English, known as the Martyr. He succeeded his father, Edgar, in 975, at the age of about 12. His succession was disputed in behalf of his half brother, Ethelred, a child of seven; but the powerful influence of St. Dunstan decided the contest in favor of Edward. He was assassinated in 978, at the instigation probably of his stepmother, Ælfthryth, who was disinherited at her failure to gain the crown for her son Ethelred. Consult: Green, *The Conquest of England* (London and New York, 1883); Hodgkin, *History of England, from the Earliest Times to the Norman Conquest* (London, 1906); Oman, *England before the Norman Conquest* (ib., 1910).

**EDWARD, or EADWARD** (c.1004-86). King of the English from 1042 to 1066, known as the CONFESSOR. He was the elder son of Ethelred the Unready and was born at Islip in Oxfordshire, about the year 1004. On the death of Edward's father, in 1016, he followed soon after by the death of Edmund Ironside (q.v.), Canute, the Dane, obtained possession of the throne and in the following year married Emma, the mother of Edward, by whom he had a son named Hardicanute, or Harthacnut. Until the death of Canute, in 1035, Edward lived in Normandy. Then he made an ineffectual attempt to establish his authority in England but his mother, Emma, sided with her younger son, Hardicanute, who on the death of Harold his half brother, in 1040, became sole ruler of the English kingdom. Hardicanute probably invited Edward to England, where he was honorably received. On the death of Hardicanute, in 1042, Edward was elected King. The person chiefly instrumental in bringing about this result was Earl Godwine, whose only daughter Edith, or Eadgith, became Edward's wife in 1045. For a number of years the reign of

government were practically in the hands of Earl Godwine and his sons, who were powerful enough at times openly to impose their will upon the King. Edward himself showed little inclination for the affairs of government, and his mild disposition and ascetic temperament made him as little sensible to the attractions of worldly power as to the charms of his beautiful wife. His life was passed for the greater part in holy works, his most lasting monument being Westminster Abbey, which he caused to be built. He died Jan. 5, 1066. The honor of canonization and the title of Confessor were conferred on him in 1161 by Pope Alexander III. The whole of his reign is simply the record of the growth of the Norman, or court, party and its struggle with the National, or Anglo-Saxon, party—for an account of which, see GODWINE; HAROLD. Wars with the Welsh in 1057 and 1063 and with the Northumbrians in 1065 were short and successful. Consult Freeman, *The Norman Conquest*, vol. ii (Oxford, 1877), this giving the fullest and best account of Edward's reign; Hodgkin, *History of England, to 1066* (London, 1906); Oman, *England before the Norman Conquest* (ib., 1910). See ANGLO-SAXONS.

**EDWARD I** (1239-1307). King of England from 1272 to 1307. He was the eldest son of Henry III by his wife, Eleanor of Provence, and was born at Westminster, June 17-18, 1239. In 1252 his father bestowed upon him the lordship of Gascony, and in 1254, on his marriage to Eleanor of Castile, he received, as an additional gift from his father, Ireland and Wales and the towns of Bristol, Stamford, and Grantham. In his early years he was surrounded by foreigners and was guilty of many injudicious and some cruel actions. The misgovernment of Wales by his officials led to a revolt in which the Welsh allied themselves with the Scotch. A dangerous war followed, which brought to a head the general discontent which prevailed in England over the bestowal of great offices of state upon foreigners and the King's subserviency to the see of Rome. The Provisions of Oxford (q.v.), greatly limiting the power of the crown, were drawn up by Parliament, and both Edward and his father were compelled to swear to observe them. Edward, however, used the opportunity afforded by the divisions among the nobility to place himself at the head of the party of the lesser nobles, who were opposed to the great barons. War broke out in 1263. There were many indecisive engagements; after the battle of Lewes (1264) Edward was made a hostage for his father's conduct and was treated as a prisoner. He escaped in May, 1265, and on August 4 won a complete victory over his opponents at Evesham. The resistance of the barons, nevertheless, dragged on until July, 1267. The defeated were treated with great moderation, and Edward showed by prudence and wisdom that he had outgrown the faults of his youth. In 1268 he assumed the Crusader's cross, and in 1270 set out to join Louis IX of France on his crusade. Louis died on the coast of Africa, and the French Crusaders made peace with the Mohammedans; but Edward persisted in the enterprise and landed at Acre in 1271. Nothing, however, of any consequence was achieved, and in the following year he set out on his return to England. In Sicily he heard of his father's death (1272), but did not hurry home. In 1273 he proceeded

to France and did homage to Philip III for his French possessions. He arrived in England, Aug. 2, 1274, and, with his Queen, Eleanor, was crowned at Westminster on August 19. His first military expedition after his accession to the throne was directed against the Welsh. After an intermittent contest of nearly 10 years—in the course of which the famous Prince Llewellyn (q.v.) was slain at Radnor, Dec. 11, 1282—Wales was finally subdued and incorporated with England.

Edward's great ambition was to gain possession of Scotland. The death, in 1290, of Margaret, the Maid of Norway, granddaughter of Alexander III, who was to have been married to Edward's son, seemed for a time to have frustrated his design; but the selfishness of the competitors for the Scottish crown induced them . . . Edward as Lord Paramount of . . . hoping that he would thereby secure the English monarch's support. John Baliol and Robert Bruce were also foolish enough to make him umpire between them; or perhaps it would be more correct to say they were not powerful enough to refuse his arbitration. At Berwick, Nov. 17, 1292, Edward decided in favor of John Baliol, who immediately took the oath of fealty to him, and on December 26 did homage to the English King for his crown at Newcastle. The . . . pride of the Scottish nation took fire at such humiliation, and in a short time Baliol was hurried by his subjects into a war with England. In 1296 Edward entered Scotland, devastating it with fire and sword. He penetrated as far north as Elgin, compelled Baliol to resign the throne, and governed the country by means of a board of regency. It was during this expedition that he carried off from the cathedral of Scone the celebrated stone on which the kings of Scotland used to be crowned and which is now in Westminster Abbey. A second rising took place in Scotland in the following summer. The leader on this occasion was William Wallace. He was completely successful for a time, chiefly, it is supposed, on account of the absence of Edward. In the spring of 1298, however, that sovereign again made his appearance in Scotland and gave battle to Wallace at Falkirk on July 22. Partly through treachery and partly, no doubt, through the superior generalship of Edward, who is considered to have been the first military commander of his time in Europe, the Scottish forces were entirely defeated. The next five years were spent by the English in reducing the country to obedience—with very imperfect success, however. In the summer of 1301 Edward led a third army into Scotland, but soon made a truce; in 1303 he once more spread havoc and ruin to the shores of the Moray Firth. The last castle that held out against him was Stirling, which did not yield until July 24, 1304. Some time after this Wallace either fell into his hands or was betrayed, and on Aug. 23, 1305, was executed. In the beginning of 1306 Robert Bruce, Earl of Carrick, grandson of the chief rival of Baliol, suddenly left the English court, unfurled once more the banner of Scottish independence, and on March 27 of that year was crowned at Scone. An English army under the Earl of Pembroke was immediately dispatched to Scotland, and at the close of the year the King himself set out to chastise Bruce. But Edward only lived to reach Burgh-on-Sands, a village beyond Carlisle, where he expired July

7, 1307, "in sight of the country," says Lord Hailes, "which he had devoted to destruction."

As a ruler, Edward is entitled to the highest praise. Immense progress was made during his reign in the establishment and improvement of law and order throughout the land, in the reformation of civil abuses, and in the restriction of the ecclesiastical power. He has been called the English Justinian, and both Hale and Blackstone affirm that "the very scheme and model of the administration of common justice between man and man was entirely settled by this King." Ireland and Wales participated in the benefits of English law. It was during Edward's reign, too, that the representation of the Commons of England first became regular; but probably the greatest advantage obtained by the nation was the declaration that the right of levying taxes resided in Parliament. In general, it may be said that Edward ruled in harmony with the ideas and desires of the best heads among his nobles and burgesses; and though touchy on the question of his prerogative, like every Plantagenet, and cruel in his treatment of the Jews, he must be regarded, on the whole, as one of the most enlightened and sagacious monarchs of his age. Consult: Stubbs, *Constitutional History of England*, vol. ii (Oxford, 1896); id., *The Early Plantagenets* (London and New York, 1877); Prothero, *Simon de Montfort* (London, 1877); Tout, *Edward I* (London and New York, 1893); Jenks, *Edward Plantagenet* (New York, 1902); Tout, *Political History of England, 1216-1377* (London, 1905); Vickers, *History of England, 1272-1485* (ib., 1912).

**EDWARD II.** A tragedy by Christopher Marlowe (about 1590), published 1598.

**EDWARD II** (1284-1327). King of England from 1307 to 1327. He was the son of Edward I and was born at Carnarvon, April 25, 1284. In 1301 he was created Prince of Wales, being the first heir apparent to the English throne who bore that title. He accompanied his father on his expeditions into Scotland, but after the death of the latter he abandoned the personal conduct of the war and returned to England. At home Edward's mode of life was contemptible. While still a youth he had conceived an extraordinary admiration and fondness for a witty, clever, but dissolute courtier called Piers de Gaveston, the son of a Gascon knight. After Edward became King there was no limit to the honors heaped on the favorite. When the King went to France in the beginning of 1308, to conclude a marriage with Isabella, daughter of Philip the Fair, Gaveston was left as guardian of the kingdom. The nobles were indignant and demanded his banishment. Twice Gaveston was forced to leave England, but as often he was recalled by the weak monarch, whose love for him amounted to sheer infatuation. At last the nobles rose in arms, besieged Gaveston in Scarborough Castle, and, having forced him to surrender, hanged him June 19, 1312. Two years after this Edward invaded Scotland at the head of a great army, amounting, according to some historians, to 100,000 men. At Bannockburn, on June 24, 1314, he was encountered by Robert Bruce (q.v.) and defeated with immense slaughter. Finally, in 1319, after numerous petty successes on the part of the Scotch, Edward concluded a truce with them for two years. Once more he fell under the influence of unscrupulous favorites, the persons selected

on this occasion being the two Despensers. Once more the nobles rebelled and both Hugh le Despenser and his father were banished in July, 1321; but some months after they were recalled by Edward. Many of the rebellious nobles, among others the Earl of Lancaster, were beheaded in the following year. Immediately thereafter Edward invaded Scotland for the last time, but, having achieved no success, concluded a truce with that country for 13 years and returned to England. A dispute now arose between him and Charles IV of France, brother of his wife, Isabella, in regard to the territories which the English King held in that country. When Charles seized the lands in question, Edward sent over Isabella to remonstrate, and, if possible, to effect an amicable arrangement between them. Isabella, it would appear, despised her husband and disliked the Despensers. Meeting at the French court many English nobles who had left their country to avoid the enmity of the favorites, she was easily induced to make common cause with them against her husband and the Despensers. She obtained possession of the young Prince of Wales (afterward Edward III) and landed at Orwell, in Suffolk, Sept. 24, 1326. The Queen and the banished nobles were soon joined by all the influential persons in England. Edward fled, but was taken prisoner. The Despensers, father and son, were executed, and the monarch himself, after being formally deposed by Parliament, Jan. 20, 1327, was murdered in Berkeley Castle on September 21 of the same year. He left two sons and two daughters. Consult: Stubbs, *Constitutional History of England*, vol. ii (Oxford, 1896); Tout, *Political History of England, 1216-1377* (London, 1905); Vickers, *History of England, 1272-1485* (ib., 1912). See BANNOCKBURN; DESPENSER; GAVESTON.

**EDWARD III** (1312-77). King of England from 1327 to 1377. He was the son of Edward II and was born at Windsor, Nov. 13, 1312. He was chosen King by Parliament on Jan. 14, 1327, six days before a formal resignation was extorted from the unhappy Edward II (q.v.). During his minority the country was governed nominally by a council, but in reality by the Queen mother, Isabella, and her lover, Mortimer. On Jan. 24, 1328, Edward married Philippa, daughter of the Earl of Hainault. Two years later, resolving to take the power in his own hands, he seized Mortimer, put him to death, Nov. 29, 1330, and banished his mother to her house at Rising, where she was kept until her death. In 1333 Edward, claiming that the Scots had violated the truce between the two countries, invaded Scotland. A bloody battle was fought at Halidon Hill, near Berwick, July 20, 1333, in which the Scots were completely defeated. Edward Baliol was restored to the throne and surrendered part of his kingdom to Edward. In the course of three years Edward thrice invaded Scotland; but though he laid the country waste and brought armies with him that effectually crushed all opposition, he could not break the spirit of the people. The scene of Edward's great exploits, however, was France. As all the sons of Philip the Fair had died without male heirs, Isabella, his daughter, claimed the Kingdom of France for her son Edward. Most French authorities, however, held that the crown could descend only in the male line, and accordingly Philip VI (q.v.), the nephew of Philip the Fair, was recognized

as King. For several years hostilities were averted: but when France, in 1337, interfered to aid Scotland, Edward declared war against France. This was the beginning of the Hundred Years' War. The early conflicts were of little importance; but in 1346 Edward, accompanied by his eldest son, the Black Prince, made a new invasion of France, conquered a great part of Normandy, marched to within a few miles of Paris, and on August 26 of that year inflicted a tremendous defeat on the French at Crécy (q.v.). Here Edward, the Black Prince, though only 16, exhibited the courage and prowess of a veteran. After some further successes, such as the reduction of Calais, a truce was concluded between the two nations for nine months. Meanwhile the Scots had sustained a severe defeat at Neville's Cross, near Durham, Oct. 17, 1346, their King, David II, being taken prisoner. On Sept. 19, 1356, the Black Prince obtained a brilliant victory at Poitiers, King John of France falling into his hands. The Scottish monarch was released for a ransom of £100,000 in 1357, and King John for a ransom of 3,000,000 crowns in 1360. On Nov. 27, 1363, David, King of Scotland, entered into a secret agreement with Edward, in virtue of which his kingdom, if he died without male issue, was to pass to the English sovereign. Meanwhile the Black Prince, who had married Joanna, daughter of the Earl of Kent, had received from his father Aquitaine and Gascony and ruled there for some time prosperously. War with France broke out again in 1369; the English were unsuccessful, and in 1375 a truce was concluded on account of the exhaustion of both parties. Edward waged war no more. In spite of his brilliant victories, and in spite of the dazzling valor of his son, he failed to achieve lasting success. Neither in Scotland nor in France did he realize his ambitions. Affairs at home were no less unsatisfactory during the last years of his life. He quarreled with his parliaments, and the Black Prince sided with the opposition. The aged King fell completely under the control of his mistress, Alice Perrers, and of a small coterie of unscrupulous courtiers, headed by the King's son, John of Gaunt, Duke of Lancaster. Edward died on June 21, 1377. By his wife, Philippa, he had seven sons and five daughters, seven of whom died young. Edward was fond of all knightly amusements and throughout his reign acted the part of a knight rather than that of a king. He was hard-hearted and selfish and never won the love of his people. He died deserted by all. His private life was immoral, and his public actions governed only by his own interests. Among the laws of Edward's reign were several which attacked papal claims to religious taxes. Consult: Longman, *Life and Times of Edward III* (London, 1869); Stubbs, *Constitutional History of England*, vol. ii (Oxford, 1896); Green, *History of the English People*, vol. i (London, and New York, 1878); Mackinnon, *History of Edward III* (London, 1900); Tout, *Political History of England, 1216-1377* (ib., 1905); Vickers, *History of England, 1272-1485* (ib., 1912). See HUNDRED YEARS' WAR; SCOTLAND.

**EDWARD IV** (1442-83). King of England from 1461 to 1483. He was the son of Richard, Duke of York, and was born at Rouen in 1442. His title by inheritance was that of Earl of March. After the death of his father, in the battle of Wakefield, Dec. 30, 1460, Edward

became the head of the Yorkist party and as such speedily reestablished the fortunes of his house. After routing the Royal or Lancastrian forces, under the earls of Pembroke and Ormond, at Mortimer's Cross, near Hereford, Feb. 2, 1461, Edward marched towards London, which he entered on February 26. He immediately laid his claim to the crown before Parliament, which admitted its validity, and on March 4 he ascended the throne as Edward IV amid the acclamations of the citizens of London, with whom he was a great favorite. His first victory as King over the Lancastrians was obtained at Towton, in Yorkshire, on March 29, 1461. This was followed by minor successes, till finally, in May, 1464, by the victories of Lord Montague, the Lancastrians were completely crushed. On May 1, 1464, Edward married Elizabeth Woodville, widow of Sir John Grey. This marriage gave great offense to the Earl of Warwick, by far the most powerful of Edward's adherents, who was at that time engaged in negotiating a marriage between Edward and the sister-in-law of Louis XI of France. The favors showered upon the Queen's relatives caused great discontent. In 1469 Warwick openly declared against Edward, joined Queen Margaret, the wife of the helpless Henry VI and the intrepid leader of the Lancastrians, and finally compelled Edward to flee the country. Henry VI was released from the Tower, where he had been a prisoner for six years, and was once more invested with the royal authority. But in the spring of 1471 Edward landed at the Humber, proceeded to London, seized the person of Henry, and was again hailed King by the inhabitants. Warwick now gathered an army and hurried to encounter him. The two met at Barnet, where Warwick was defeated and slain, April 14, 1471. On May 4 Edward routed the Lancastrians at Tewkesbury, capturing Queen Margaret. Her son, Prince Edward, was either slain in battle or murdered the day after the fight. Henry VI died May 21, 1471, not without suspicion of murder. Though the later years of Edward's reign were peaceful and marked by few political incidents of any moment, the period was one of great importance in the development of the English constitution. Easygoing as he was and fond of pleasure, the King steadily pursued his aim of aggrandizing the crown at the expense of Parliament, and by a policy of silent but aggressive assertion he succeeded in laying the foundations for the absolute monarchy of the Tudors. Edward was brave and debonaire, as his immense popularity shows, but he was disolute in the extreme. By his wife he had 10 children, of whom seven outlived him. It was during his reign that printing and silk manufactures were introduced into England. In law few notable changes occurred, but the practice of indirect pleading dates from this period, which is also illustrious for the names of distinguished legists, such as Littleton and Fortescue. Consult: Ramsay, *Lancaster and York* (2 vols., Oxford, 1892); Oman, *Political History of England*, vol. iv (London, 1906); Vickers, *History of England, 1272-1485* (ib., 1912); Green, *History of the English People* (London and New York, 1878). See Henry VI; ROSES, WAR OF THE; WARWICK, RICHARD NEVILLE, EARL OF.

**EDWARD V** (1470-83). King of England. The son of Edward IV, he was born in the Westminster Sanctuary, Nov. 4, 1470. When



his father died, he was 13 years old. He proceeded to London for his coronation, which had been appointed for May 14, 1483, but was removed from the care of his maternal relatives by his paternal uncle, Richard, Duke of Gloucester, who in the same month had himself proclaimed Protector of the Kingdom and confined Edward and his younger brother, the Duke of York, in the Tower. The rumor of their death spread, when a movement originated for their liberation, but was discredited, popular opinion maintaining that they had been exiled. Twenty years later it transpired that Brackenbury, Constable of the Tower, refused to slay the princes at Richard's command, and Sir James Tyrrel, with two servants, gained admittance to their chamber while they were asleep, smothered them with pillows, and buried them at the foot of a staircase. The skeletons found at the foot of a staircase in the White Tower in the reign of Charles II and buried at his command in Westminster Abbey are considered to have been those of the young princes.

**EDWARD VI (1537-53).** King of England from 1547 to 1553. The son of Henry VIII by his third wife, Jane Seymour. Edward was born at Hampton Court, Oct. 12, 1537. He succeeded to the throne after his father's death, Jan. 28, 1547, his uncle, Edward Seymour, Earl of Hertford, being chosen Protector and created Duke of Somerset. Edward received a careful education and was a studious, religious, and precocious youth; but he was too young to exercise any personal influence on the important events of his reign. His religious convictions, however, were shared by the Protector, who favored the principles of the Reformation, and during his rule great strides were made towards the establishment of Protestantism in England. The images were removed from the churches; the laity were allowed the cup at the ceremony of the Lord's Supper; Henry's famous six articles (known as the Bloody Statute) were repealed; and a new service book, known as the First Prayer Book of Edward VI (see PRAYER BOOK, COMMON), was compiled by Crammer and Ridley, assisted by 11 other divines, and ordered to be used. During the first year of the protectorate Seymour invaded Scotland, on account of the refusal of the Scottish government to fulfill the contract into which it had entered with Henry VIII that Mary, Queen of Scots, should marry Edward. At the battle of Pinkie, Sept. 10, 1547, the Scots were completely beaten; but Seymour, before he could inflict other damage, was required at home and returned to find that his brother, Lord Seymour, had been intriguing against him. Somerset had him arrested, tried, and condemned for treason, and on March 30, 1549, he was beheaded on Tower Hill. In the summer of the same year the Protector quelled an insurrection of the populace headed by one Kett, a tanner; but a more dangerous adversary appeared in John Dudley, Earl of Warwick, whose party, by insinuations against Somerset, excited the nation against him and compelled the King to sign his deposition. In October, 1551, Somerset was placed in the Tower; and on December 1 he was tried before the House of Lords for treason, condemned, and executed, Jan. 22, 1552. Before Somerset's execution Dudley had been created Duke of Northumberland. He was (judging from his dying declaration) a Catholic, but took no action to reestablish the old religion. His great aim was

to secure the succession to the throne of England for his family. With this view he married his son, Lord Guildford Dudley, to Lady Jane Grey, daughter of the Duchess of Suffolk, to whom Henry VIII had willed the crown in default of issue by Edward, Mary, or Elizabeth. Northumberland worked upon the consumptive and dying Edward to exclude Mary and Elizabeth on the ground of illegitimacy and to nominate Lady Jane Grey as his successor. Edward consented, and a document settling the succession on this lady was drawn up in June, 1553. The King lived only a few weeks after, dying on July 6. Edward's educational accomplishments were somewhat discounted by shrewdness and a hardness of character, which were exemplified by marked callousness when signing the death warrants of Seymour and Somerset. Edward VI restored many of the grammar schools suppressed by Henry VIII. These schools are still known as King Edward's schools. Consult: Nichol, *Literary Remains of Edward VI* (2 vols., London, 1857); Gasquet and Bishop, *Edward VI and the Book of Common Prayer* (ib., 1891); Markham, *Edward VI* (ib., 1907); Fisher, *History of England, 1485-1547* (ib., 1906); Pollard, *History of England, 1547-1603* (ib., 1910); Innes, *England under the Tudors* (ib., 1905).

**EDWARD VII (1841-1910).** King of the United Kingdom of Great Britain and Ireland, and of all the British Dominions beyond the Seas, Emperor of India. The second child and eldest son of Queen Victoria and the Prince Consort, Albert (q.v.). He was born in Buckingham Palace, London, on Nov. 9, 1841, and was christened Albert Edward. He succeeded his mother on Jan. 22, 1901. At his birth he was created Prince of Wales, and by virtue of that dignity he became also Knight of the Garter. As heir apparent to the British throne, he succeeded to the title of Duke of Cornwall and its emoluments. As heir to the crown of Scotland, he became Great Steward of Scotland, Duke of Rothesay, Earl of Carrick, Baron Renfrew, and Lord of the Isles. On Sept. 10, 1849, he was created Earl of Dublin, a title conferred on him and his heirs in perpetuity. Additional titles and commands borne by him were: Duke of Saxony, colonel of the Tenth Hussars, colonel in chief of the Rifle Brigade, field marshal of the British army (1875), also of the German army (1883). He received an elaborate and carefully planned education under four private tutors and subsequently under Baron Stockmar and Charles Kingsley. He spent a session at Edinburgh University, a year at Christ Church, Oxford, and four terms at Cambridge. In 1860 he traveled as Baron Renfrew through Canada and the United States. In June, 1861, he joined the army at the Curragh Camp, Ireland. The next year, during the period of mourning which followed the death of his father, he made a tour of the Orient, accompanied by Dean Stanley of Westminster, and visited Jerusalem and other places of biblical interest.

In February, 1863, his public life was formally begun, when, as heir to the throne, he took his seat in the House of Lords, and on March 10 of the same year he married Princess Alexandra Caroline Mary Charlotte Louisa Julia, eldest daughter of King Christian IX of Denmark, born Dec. 1, 1844. They had six children: 1. Prince Albert Victor Christian Edward, Duke of Clarence and Avondale, born Jan. 8, 1864; died Jan.

14, 1892. 2. Prince George Frederick Ernest Albert, Prince of Wales, formerly Duke of York, born June 3, 1865; married Princess May of Teck, July 6, 1893. 3. Princess Louisa Victoria Alexandra Dagmar, born Feb. 20, 1867; married, July 27, 1889, to the Earl, afterward Duke, of Fife. 4. Princess Victoria Alexandra Olga Mary, born July 6, 1868. 5. Princess Maude Charlotte Mary Victoria, born Nov. 26, 1869; married, July 22, 1896, to Prince Charles of Denmark. 6. Prince Alexander John Charles Albert, born April 6, 1871, who died the next day.

In 1868-69 the Prince with the Princess of Wales visited Ireland and the Continent, extending their tour to include Egypt. In 1871, an attack of typhoid fever having endangered his life, his recovery was enthusiastically celebrated throughout the Empire. His popularity was seen in the lavish hospitality and the loyalty shown him in 1875-76 during his tour through India. The years of his mother's widowhood and virtual retirement were for the Prince a long period of preparation for his duties as King. Upon him fell not only the leadership of British society, but especially the arduous duties of representing the crown at innumerable public functions. The tact with which he performed these duties enhanced his popularity at home, and his influence abroad. Among his activities during these years should be mentioned his large responsibility for the Queen's notable Jubilees of 1887 and 1897. As a patron of art and science, the Prince was largely instrumental in the promotion of the Royal College of Music and the Imperial Institute. He patronized the Welsh Eisteddfod and in 1896 became first chancellor of the University of Wales. He served as Grand Master of English Freemasons and was a bencher and officer of the Middle Temple. He showed active interest also in exhibitions in housing of the poor, and charities. In 1897 he established a hospital fund which he maintained as King. With careful regard for British jealousy of royal interference in politics he avoided all appearance of partisan preferences. However, he maintained friendly and courteous relations with all public men and thus was able at several critical times by his visits to Gladstone, Bright, and other Liberal leaders to counteract the impression made upon public opinion by the Queen's preferences for Conservative ministers.

His London residence was at Marlborough House, but at Sandringham, Norfolk, he lived as a typical English country gentleman, giving much care to the improvement of his estates and to the breeding of fine stock. He was, likewise, a keen sportsman, taking especial interest in yachting and horse racing. These interests largely offset in the popular mind other circumstances which, like his connection with the Tranby Croft baccharat case (1890), tended to compromise his private reputation.

When he became King upon the death of Queen Victoria, Jan. 22, 1901, he was, save William IV, the oldest ruler to receive the English crown since Egbert. One of the acts of the Parliament which met a few weeks after his accession was to amplify the royal title so as to embrace "all the British Dominions beyond the Seas." His coronation was set for June 26, 1902, and preparations had been perfected for its celebration with ceremonial pomp such as England had not witnessed in generations, when

a few days previous to the date set rumors of the King's illness were confirmed by the announcement that he was suffering from perityphlitis. The ceremonies were postponed, and on June 24 an operation was performed which proved successful, and the coronation in the Abbey took place on August 9, although other festivities were deferred for several months.

The year following his coronation, and again in 1904, the King visited Ireland and held court at Dublin. He was received with popular enthusiasm because of his well-known interest in the welfare of his Irish subjects. By similar state visits to the Continent, which were usually returned by the sovereigns visited, he contributed greatly to the maintenance of European peace and won for himself a rôle for which he was happily fitted by his personality and aided by his extensive family connections with most of the European rulers. Among the most significant of these political visits were those with the German Emperor in 1904 and 1908, the meeting with the Czar at Reval in 1908, and the interchange of visits the same year with President Fallières of France. King Edward was also interested in promoting the increasingly cordial relations with the United States. The results of these amicable relations may be seen in the British policy during the Russo-Japanese War, in the *entente* reached with France, and in the various arbitration treaties made by Great Britain during this reign.

At home the King maintained the popularity which he had earned as prince by his deep interest in philanthropic enterprises. He also instituted the Edward medal for deeds of heroism by civilians, and he founded the Order of Merit for distinction in war, science, and literature and the service of man. In the last months of his reign the measures of the Asquith ministry, especially the Lloyd-George land taxes and the crisis with the House of Lords, caused the King much anxiety. His death came unexpectedly on May 6, 1910, from heart failure incident to a bronchial attack. After lying in state for three days at Westminster Hall the body of the King was taken, on May 20, to Windsor for burial. The funeral was notable for the number of foreign sovereigns and important public men who participated. It was a fitting testimony to the universal esteem with which King Edward was regarded. Consult: *The Private Life of King Edward VII* (New York, 1901); *Life of the King*, by "One of His Majesty's Servants" (London, 1901); Hopkins, *Life of King Edward VII* (Philadelphia, 1902); Holt-White, *The People's King* (New York, 1910); Watson, *King Edward VII as a Sportsman* (London, 1911); Legge, *King Edward in his True Colours* (ib., 1912). For a brief comprehensive account and a good bibliography, consult *The Dictionary of National Biography*, 2d supplement, vol. i (New York, 1912).

**EDWARD, THE BLACK PRINCE** (so named from the color of his armor) (1330-76). The eldest son of Edward III of England. He was created Duke of Cornwall in his seventh year and a year later, during the absence of his father, who was embarking on his war against France, was appointed nominal guardian of the kingdom. He held this office again in 1340 and 1342 and was created Prince of Wales in 1343. Three years later he accompanied his father to France and in the battle

of Crécy (q.v.) led the most gallant division of the army. He also shared his father's glory in the victories which followed. In 1355 he was given command of the chief army in the French War, landed at Bordeaux, and after several smaller successes gained, in 1356, the victory of Poitiers (q.v.), capturing the French King, John II, whom he carried captive to London in 1357. In 1361, during the short peace following King John's ransom, Edward married his cousin Joanna, the "fair maid of Kent," whose third husband he was, and being created Prince of Aquitaine and Gascony in 1362, crossed over to his new possession, which he ruled successfully and peacefully for a time. Entering into an entangling alliance with Peter the Cruel, the deposed King of Castile, he found himself burdened with the expenses and losses of a profitless war, and for the excessive taxes laid upon his duchy was summoned to account by the French King as his liege lord. To this summons Edward replied haughtily, "We will come, with our helmet on our head and 60,000 men in our company." This led to a rupture between France and England. The French planned a double invasion of the English territory in France. The Duke of Anjou, commanding one expedition, besieged Limoges, which had been ceded to the English by the Treaty of Bretigny and formed part of the Principality of Aquitaine. The city was surrendered by the treachery of its Bishop. The Black Prince, enraged by this act, after a siege of a month recaptured the city by assault (1370) and is said to have put to the sword 3000 of its inhabitants. This outburst of cruelty is the chief blot on the fame of the Prince, and it is only partially explained by his disordered health, which itself was perhaps due to the irritation of seeing the English power waning in France, in spite of all his victories. He was compelled by the advice of his physicians to return in 1371 to England, where, except for a short and unsuccessful expedition against France in 1372, he lingered in continually failing health for five years. In these years he saw the loss of Aquitaine, but he did good service to the country in opposing the corrupt and oppressive influences which surrounded the dotting Edward III, and by his help Parliament was able to pass acts in restraint of the dangerous ambition of John, Duke of Lancaster. He died, probably in June, 1376, and was buried in the cathedral of Canterbury, where part of his armor still hangs above his tomb. His second son occupied the throne in the following years as Richard II. Consult: Longman, *Life and Times of Edward III* (London, 1869); Mackinnon, *History of Edward III* (ib., 1900); Dunn-Pattison, *The Black Prince* (ib., 1910); Tout, *Political History of England, 1216-1377* (ib., 1905); Vickers, *History of England, 1272-1485* (ib., 1912).

**EDWARD, THOMAS** (1814-86). A Scottish zoölogist and collector, known as "the Banff naturalist." He was born at Gosport, Hampshire, and at 11 years of age he was apprenticed in Aberdeen to a shoemaker, whose trade he followed throughout his life, mainly near Banff. Before he was five years old he showed an almost passionate fondness for all sorts of birds and animals, and by 1845 he had collected some 2000 species of animals, which he was compelled to sell for about £20. He then set courageously at work to make another collection, at the same time recording his observations, which his friend, the Rev. James Smith,

sent to the *Zoölogist*, where the publication of his detailed and minute descriptions of the habits of birds and beasts attracted attention from the similarity of his methods and of his accounts to those of Audubon. He later turned his attention enthusiastically to marine zoölogy and discovered 20 new species of *crustacea* in the Moray Firth. In 1866 came the first recognition of the scientific value of his researches, in an election as an associate of the Linnæan Society of London. In 1876, through the influence of Charles Darwin and a biography of Edward, written by Samuel Smiles, he received an annual civil-list pension of £50. Consult Smiles, *Life of Thomas Edward* (London, 1876).

**EDWARDES, SIR HERBERT BENJAMIN** (1819-68). A British East Indian soldier and administrator. He was born at Frodesley, in Shropshire, was educated at King's College, London, and entered the Indian army as a cadet in the First Bengal Fusiliers in 1840. He won promotion rapidly and served on the staff of Sir Hugh Gough, the British commander in chief in the first Sikh War, in 1845-46. In 1847 he was made first assistant to Sir Henry Lawrence, the British resident at Lahore. In the summer of 1848 he suppressed an uprising in Mooltan and for his services received the thanks of both Houses of Parliament and was brevetted major. He wrote an account of the campaign, entitled *A Year on the Punjab Frontier in 1848-49*. During the Indian Mutiny in 1857 Edwardes rendered invaluable services by securing the neutrality of Afghanistan, thus enabling the troops to be withdrawn from the northwest border and used effectively in the relief of Delhi and Lucknow. He was offered the governorship of the Punjab in 1862, but refused it on account of failing health, which compelled his return to England. He died shortly after being promoted to the rank of major general. The town of Banu in the Punjab was renamed, in his honor, Edwardesabad.

**EDWARDS, ALPHONSE and HENRI MILNE.** See MILNE-EDWARDS.

**EDWARDS, AMELIA ANN BLANDFORD** (1831-92). An English novelist and Egyptologist, born in London, June 7, 1831. As a contributor to various magazines and newspapers, she gave early evidence of considerable literary ability. She first attracted attention as an author by *My Brother's Wife*, which appeared in 1855. This was followed in 1859 by *Hand and Glove*, and later by *Debenham's Vow* (1870), *In The Days of My Youth* (1872), and *Lord Brackenbury* (1880). Of all her novels *Debenham's Vow* and *Lord Brackenbury* were the most successful. In 1873 Miss Edwards visited Egypt and as a result of her trip became intensely interested in Egyptology. In 1877 she published an account of her own explorations on the Nile in a book entitled *A Thousand Miles up the Nile*. This she illustrated by sketches from her own hand. It was largely through her interest in the ruins of Egypt and a desire to preserve them that the Egyptian Exploration Fund came to be formed. In 1889-90 she lectured in the United States, and these lectures appeared in 1891 in book form under the title, *Pharaohs, Fellahs, and Explorers*. The last 10 years of her life were devoted to the study of Egyptology. In this field she contributed to the ninth edition of the *Encyclopædia Britannica*, to the American supplement of that work, and to the *Standard*

*Dictionary*. Her collection of Egyptian antiquities was bequeathed to University College, London.

**EDWARDS, ARTHUR** (1834-1901). An American clergyman and editor, born at Norwalk, Ohio. He graduated from Ohio Wesleyan University in 1858 and entered the Methodist ministry the same year, joining the Detroit conference. As chaplain of the First Michigan Infantry, he served in the Civil War until after the battle of Gettysburg; he was in 18 battles altogether and was offered a brevet of colonel. In 1864 he became assistant editor of the *Northwestern Christian Advocate* of Chicago and from 1872 until his death he was editor. He was honored by his denomination in many ways—in 1876 he was a member of the committee which revised the Church Hymnal, and he was a member of seven general conferences and of the ecumenical Methodist conference (London, 1881), before which body he read a noteworthy paper on "The Status of Methodism in the Western Hemisphere." For 12 years he was secretary of the Detroit conference. He was editor of the *Daily Christian Advocate* at the general conference of 1868.

**EDWARDS, BELA BATES** (1802-52). An American clergyman and author, born at Southampton (Hampshire Co.), Mass. He graduated at Amherst College in 1824 and at Andover Theological Seminary in 1830. In 1837 he was elected professor of Hebrew, and in 1848 associate professor of sacred literature, at Andover. At various times he was the editor of periodicals, including the *American Quarterly Register* from 1828 to 1842, the *American Quarterly Observer*, which he founded, from 1833 to 1835, and the *Bibliotheca Sacra* from 1844 until his death. He was also a founder of the Society for Ameliorating the Condition of the Slave and of the American Missionary Association. As a scholar and educator, he was very highly ranked. His published works include: *The Missionary Gazetteer* (1832); *The Biography of Self-Taught Men, with an Introductory Essay* (1832); a *Memoir of Reverend Elias Cornelius* (1833); *Classical Studies: Essays on Ancient Literature and Art, with the Biography and Correspondence of Eminent Philologists*, with B. Sears and C. C. Felton (1843); and a translation with S. H. Taylor (7th ed., 1860) of Raphael Kühner's *Schulgrammatik der griechischen Sprache* (Hanover, 1836). Two volumes of his addresses and sermons were published, with a memoir by Park (Boston, 1853).

**EDWARDS, BRYAN** (1743-1800). A West Indian merchant and author. He was born at Westbury, Wiltshire, and went to Jamaica in 1759, where he soon became a prosperous merchant. As a member of the Colonial Assembly, he advocated closer commercial relations with the United States. In 1792 he returned to England, established a bank at Southampton, and was elected in 1796 to the House of Commons. His principal literary production is the *History of the British Colonies in the West Indies* (5th ed., 1819; translated into German and partly also into Spanish). He also wrote a *History of St. Domingo* (1807; translated into French) and *Proceedings of the Governor and Assembly of Jamaica in regard to the Maroon Negroes* (1796).

**EDWARDS, GEORGE WHARTON** (1859- ). An American painter and illustrator, born at Fairhaven, Conn. He studied in Antwerp and

Paris and after his return to America exhibited frequently and received a number of medals. From 1898 to 1903 he was director of the art department of *Collier's*, and thereafter he was with the American Banknote Company. He wrote and illustrated many stories of experience and travels, including *Thumbnail Sketches* (1886); *Petit Matinee Monotones* (1887); *The Rivalries of Long and Short Odiac* (1888); *Break o' Day* (1889); *A Reading Journey in the Hollowland* (1908); *Brittany and the Bretons* (1910); *Old Flemish Towns* (1911); and also illustrated *The Last Leaf* of Holmes, the *Epithalamion* of Spenser, *Old English Love Songs and Ballads*, etc. His work as an illustrator for the best magazines in America is well known. His plates are well drawn, simple and direct in execution, and his water colors show daintiness and delicacy of finish. He also designed a number of effective posters and magazine covers and painted the mural decoration "Hendrik Hudson" in the United States Military Academy.

**EDWARDS, HARRY STILLWELL** (1855- ). An American journalist, novelist, and poet, born at Macon, Ga. He was a graduate in law of Mercer University, Macon (1877); served as assistant editor and editor of Macon journals (1881-88), gaining distinction as a writer of dialect stories. Noteworthy among his volumes are: *Two Runaways and Other Stories* (1889); *The Marbeau Cousins* (1898); *Sons and Fathers* (1896), a story that won a prize of \$10,000 in the Chicago Record; *His Defense and Other Stories* (1899). Mr. Edwards is strongest in studies of plantation life, as well as Georgian aristocracy as among laborers.

**EDWARDS, HENRY SUTHERLAND** (1828-1906). An English journalist and author, born in London and educated in that city and in France. He was correspondent of the London Times at the coronation of Alexander II of Russia (1856), in the camp of the insurgents at Warsaw (1862-63), at Luxembourg (1867), and at German army headquarters during the Franco-Prussian War. His publications include: *The Russians at Home and the Russians Abroad* (1861); *The Germans in France* (1874); *The Case of Reuben Malachi* (1886); *The Prima Donna: Her History and Surroundings from the Seventeenth to the Nineteenth Century* (2 vols., 1888); *Rossini and His School* (1895); *Personal Recollections* (1900); *Sir William White: His Life and Correspondence* (1902).

**EDWARDS, JOHN PASSMORE** (1823-1911). An English newspaper proprietor and philanthropist, son of a Cornish carpenter. About 1844 he became a representative of the *Sentinel*, a journal opposed to the Corn Laws. He was a delegate to peace congresses in Brussels, Paris, and Frankfort (1848-50). His publishing ventures were failures for a time, but in 1862 he bought the *Building News*, with which he made money, and in 1876 he bought the pioneer halfpenny evening paper, the *London Echo*, of which he was editor for 20 years. He was a member of Parliament in 1880-85 and in politics was a follower of Gladstone until the Home Rule Bill. He founded several "Passmore Edwards Institutions," public libraries and settlements—especially in London and Cornwall—and a scholarship at Oxford for the study of English and classical literatures together. He twice refused knighthood. His opposition to

the Boer War made him somewhat unpopular. Consult his privately printed autobiography, *A Few Footprints* (London, 2d ed., 1906).

EDWARDS, JONATHAN (the elder) (1703-58). The most celebrated early American divine and metaphysician. He was born at East Windsor, Conn., Oct. 5, 1703, the only son in a family of 11 children of the Rev. Timothy Edwards, the parish minister. He was a precocious child and at 13 entered the Collegiate School at Saybrook, afterward Yale College. Here his mind turned most readily to the profounder studies, and when he graduated with the valedictory at New Haven in 1720, he had already arrived at those great leading principles which formed the staple of his later thinking and constitute his chief contribution to the thought of his age. He was deeply influenced by Locke, whose *Essay* he read with eager interest in his sophomore year. This influence, combined with others more or less obscure, led to the construction of an outline of idealistic philosophy closely akin to Berkeley's. After graduation he was for a time tutor in his college. In 1727 he was ordained and installed colleague with his grandfather, the Rev. Solomon Stoddard, in Northampton, Mass., where he continued till dismissed in 1750. In 1731 he preached in Boston as the "public lecture" a sermon, *God Glorified in Man's Dependence*, which won him immediate recognition as a leader in the defense of Calvinism in a community largely affected by tendencies popularly designated as Arminian. In 1734 he delivered in Northampton a series of discourses, including a remarkable sermon on the *Reality of Spiritual Light*, combining the theology of Calvinism with a deep spirit of mysticism. The result was a revival in his parish, the prelude to the "Great Awakening" of 1740 and the following years, in which Edwards was a leader. The town of Northampton was transformed, but in the country at large the value and genuineness of the revival was much questioned. Edwards was therefore led into an elaborate defense of it in his treatise *Faithful Narrative, etc.* (1736). Other works of this period are directly or indirectly connected with the revival: *Distinguishing Marks of a Work of the Spirit of God* (1741); *Thoughts on the Revival of Religion* (1742); and *The Religious Affections* (1746), his chief work in experimental religion. He had now become a power throughout New England and had acquired a well-founded fame even across the seas.

But the regular progress of his life was to be rudely interrupted. It had been the custom under his predecessor to admit persons not of scandalous life, but not professing conversion, to the Lord's Table as a means of grace. Edwards became convinced by the experiences of the revival that this practice, so contrary to the original theory and practice of New England, was mischievous, and that no one ought to be admitted to membership in the church or to the communion who was not by personal profession and in "the judgment of a rational charity" a true believer in Jesus Christ. As this position involved an application of an ecclesiastical discipline to which the parish had long been unaccustomed, and as the question was complicated by a case of discipline that had affected personally individuals of great prominence and influence in the town, the position which Edwards took aroused the most violent opposition.

He was not even allowed to explain his position in the pulpit and was obliged to print his defense (*Qualifications for Full Communion*), and that few of his parishioners read. In 1750 he was dismissed by council. His prospects were thus apparently ruined; but in fact he now entered into the period of his greatest literary activity, in which he laid the foundation of his enduring fame. He obtained an appointment as missionary to the Indians at Stockbridge, which he held for the following eight years. In the quiet of this secluded spot he wrote his *Freedom of the Will*, his *Nature of Virtue*, his *Original Sin*, and his *Dissertation Concerning the End for which God Created the World*, possibly the most profoundly speculative philosophical work of the century. Here, too, he continued his acquaintance with the first and principal in the line of his successors and members of his "school," Samuel Hopkins. In 1758 he reluctantly accepted the presidency of the college in Princeton, N. J., but after a few weeks of service was removed by death, March 22, 1758.

Edwards's great fame rests upon his work as a theologian in the defense and development of the evangelical system. He was originally, and remained, a strong Calvinist. His first published discussion, that on God's sovereignty and man's dependence, shows him to be a thinker of exceptional power, and although his sermons on justification were marked by a certain conventionality of treatment, indicating the controlling influence of theological tradition, there is even here the breathing of a new spirit, as when faith is defined in a way unknown in the previous century, and identified with repentance as constituting with that the indivisible act of conversion. The treatise on the *Freedom of the Will* is an unwavering defense of determinism and contends not only that this is the teaching of Scripture and reason, but that any other view is false, absurd, and inconceivable. At the same time he earnestly repudiates the identification of this teaching with fatalism or any doctrine of necessity which denies to man the liberty essential to responsibility. The doctrine which he maintains is in fact only the position of Locke, and other writers who contend that the will is always determined in its preferences by the strongest motive, and his philosophical arguments are all drawn from their armory. But the fineness, the dialectical skill, the detail with which every conceivable objection is brought forward and demolished, and the tremendousness of the general effect, are all Edwards's own. While too much praise has often been lavished upon the book as a contribution to the permanent advancement of the theme, too much cannot well be said of its perfection of form, or of the influence which it immediately obtained and has continued to hold. It is probably the most famous book in theology that America has produced and one of the most famous philosophical works of the world. But there was much that was new in Edwards and which was destined to begin a distinct theological movement in America. In the treatise on *Original Sin* suggestions looking to a new emphasis on the voluntary character and personal nature of sin were made, which, in combination with suggestions in the *Freedom of the Will* concerning the natural power of man, led ultimately to a new anthropology, in which the doctrines of original sin, imputation, ability,

and regeneration were to undergo much modification. (See NEW ENGLAND THEOLOGY.) More directly influential was the treatise on the *Nature of Virtue*. The doctrine set forth in this work rests on the identification of being and value: the more truly real an object is, the greater is its intrinsic worth. The essence of virtue, accordingly, is love of an Infinite Being, or God, and the moral attributes of God are included in a love whose object is ultimately Himself. The virtuous love of particular being is regulated by this principle. The treatise was a posthumous one, but its leading ideas were at once adopted by Hopkins and became the underlying motive of the theory of the atonement propounded by Edwards's son. They also became the characteristic principles of the school of thought called "New England," or often "Edwardean," from Edwards himself. Other suggestions are to be found scattered up and down the pages of Edwards, many of which have greatly influenced his followers. But most of all, perhaps, should be noted his utter loyalty to truth and his fearlessness in developing and accepting all the consequences which he found logically implied in his premises.

Edwards was preëminently a religious man. As a child, he was profoundly impressed with the thought of God. He displayed modesty, humility, and serenity of spirit. Although engaging constantly in theological controversy, he is impersonal, calm, just, fair, and candid in his method of conducting the discussion. He was a student from his childhood, and extended his studies over pretty much the entire range of learning in his day. As a preacher, he was one of the first of his age. His ability to hold the attention of his audiences to long and careful trains of thought till he had convinced and won them would of itself illustrate this statement. But the well-known instances of his great power over congregations, as in the sermon at Enfield, where the people rose in their seats and wept and sobbed as he described the state of the lost, till he was obliged himself to ask them to be still, prove his ability to stir the feelings profoundly and that he felt profoundly himself.

Editions of his works are the Worcester (1808), originally in 8 vols., reprinted with additions, in 4 vols. (New York, 1858); and (the best) the Dwight edition in 10 vols. (ib., 1829-30), with memoir. Supplementary material may be found in the following: *Selections from the Unpublished Writings of Jonathan Edwards*, ed. by A. B. Grossart (Edinburgh, 1865); *Observations Concerning the Scripture Economy of the Trinity*, ed. by E. C. Smyth (New York, 1880); *An Unpublished Essay of Edwards on the Trinity*, ed. by G. P. Fisher (ib., 1903); *Selected Sermons of Jonathan Edwards*, ed. by H. N. Gardiner (ib., 1904). Some of the early writings, including the essay on the Flying Spider and fragments of a philosophical character, were carefully edited from the manuscripts by E. C. Smyth and published in the *Andover Review* (1890) and the *Proceedings of the American Antiquarian Society* (1895). Allen's *Jonathan Edwards* (Boston, 1889) is a noteworthy biography and appreciation.

**EDWARDS, JONATHAN** (the younger) (1745-1801). An American theologian, born at Northampton, Mass., the second son of Jonathan Edwards the elder. Early left an orphan, his education was provided for by friends, and he was graduated at Princeton in 1765. While in

college he was converted and after graduation studied theology with the friend of his father, Joseph Bellamy, of Bethlehem, Conn. He was tutor in Princeton (1767-69), pastor in White Haven, Conn. (1769-93), in Colebrook, Conn. (1795-99), whence he went to the presidency of Union College, Schenectady. As a theologian, his fame rests upon his reply to Chauncy upon the salvation of all men, in which he defended the usual evangelical doctrine; his reply to Samuel W. L. on *Liberty and Necessity*, in which he largely modified his father's theory of the will; and it a liberal interpretation scarcely with its . . . . . and upon his sermons on the . . . . . took part, in the last work, in the Universalist controversy then raging in New England. The Universalists of the Murray school had argued upon the basis of the standard Calvinistic theory of the atonement, that Christ had satisfied justice in behalf of all those for whom He died and paid their debt before God. But He had died for all men; therefore all men are saved. Edwards rejected the conclusion as against the Bible. But he could not deny that Christ died for all; and he therefore was led to teach that Christ did not satisfy justice in the sense of the full payment of a debt, but that the suffering of Christ was the exhibition of God's hatred of sin and love of man and so tends to draw men to God. The main idea was borrowed from Grotius, but the ideal basis of the atonement in the love of God was a new feature. Edwards thus founded the "New England" or "governmental" theory of the atonement, which maintained its place as the generally accepted theory among Congregationalists and "New School" Presbyterians for well-nigh a century. His works were published at Andover (1842), in 2 vols., with a memoir by Tryon Edwards.

**EDWARDS, MATILDA BETHAM.** See BETHAM-EDWARDS, MATILDA.

**EDWARDS, PIERREPONT** (1750-1826). An American lawyer, son of Jonathan Edwards the elder, born at Northampton, Mass. He graduated at Princeton in 1768, was admitted to the bar, began practice at New Haven, Conn., in 1771, and served in the Revolutionary army. In 1787-88 he was a member of the Continental Congress and later became United States district judge for Connecticut. He founded the Loyalist party in Connecticut, and his energy in this cause made him hated by the Colonists. After the treason of Benedict Arnold he became administrator of that officer's estate.

**EDWARDS, WILLIAM** (1770-1851). An American inventor, the grandson of Jonathan Edwards the elder. He was born in Elizabethtown, N. J. He introduced a valuable improvement in the manufacture of leather, whereby tanning was accomplished in a quarter of the usual time. This and other improvements and machines introduced by him, including a rolling machine, greatly advanced the production of leather in America. Consult his memoirs (Washington, 1897).

**EDWARDSVILLE.** A city and the county seat of Madison Co., Ill., 23 miles northeast of St. Louis, Mo., on the Wabash, the Illinois Traction, the Toledo, St. Louis, and Western, the Litchfield and Madison, and the St. Louis, Troy, and Eastern railroads (Map: Illinois, D 8). It is in an agricultural and coal-mining district and has extensive manufactures of tools, plumbing supplies, brass finishings, radiators, single-



trees, buggies, etc. The city has a Carnegie library. Settled in 1812, Edwardsville was incorporated in 1819 and at present is governed under a charter of 1872, which provides for a mayor, elected every two years, and a city council. Pop., 1900, 4157; 1910, 5014. The Kickapoo Indian Agency was situated in Edwardsville, and it was here that the United States negotiated with the Indians for a tract of land comprising more than 10,000,000 acres, now a part of the great Illinois corn belt.

**EDWARDSVILLE.** A borough in Luzerne Co., Pa., 2 miles west of Wilkes-Barre, on the Delaware, Lackawanna, and Western Railroad (Map: Pennsylvania, K 4). It is purely a residential place. Pop., 1900, 5165; 1910, 8407; 1914 (U. S. est.), 9787.

**EDWIN**, or **EADWINE** (c.585-633). A king of Northumbria. He was the son of Ella, King of Deira, and was only three years old on the death of his father, in 588. Deira was invaded by Ethelric, the King of Bernicia, and the infant Edwin was carried by his guardians into North Wales, where he was brought up. Later he lived as an exile under the protection of Cearl, King of Mercia, and Raedwald, the ruler of East Anglia. The latter in 617 raised an army, defeated and slew Ethelfrith, who had succeeded his father Ethelric, and restored Edwin to his father's throne. Soon after his return to Deira Edwin succeeded in reducing Bernicia and established the Kingdom of Northumbria. He speedily extended his power over a large part of England, his authority stretching as far west as the islands of Anglesea and Man and as far north as the town of Edinburgh, which he is believed to have fortified, and which still bears his name. Especially after 626, when he defeated the West Saxon King, Edwin was suzerain practically of all England save the Kingdom of Kent, with whose ruler he was in alliance, having married the King's sister, Ethelburh, in 625. Ethelburh was a Christian, and owing to her influence and the exhortations of the missionary priest Paulinus, Edwin with his entire witan was brought over to Christianity in 627. He had previously been acknowledged as Bretwalda, or leader of the English, and his power increased greatly after his conversion. In 633 Penda, of Mercia, the most powerful prince in England after Edwin, and the champion of the old heathen religion, united with the Welsh against the Northumbrian King, and on Oct. 12, 633, inflicted an overwhelming defeat upon him at Heathfield. Edwin himself was killed, the Kingdom of Northumbria fell apart, and Christianity for a time was extinguished in northern England. Consult: Green, *The Making of England* (London and New York, 1881); Hodgkin, *History of England to the Norman Conquest* (London, 1906); Oman, *England before the Norman Conquest* (ib., 1910).

**EDWIN AND ANGELINA.** A poem by Oliver Goldsmith, printed privately for the amusement of the Countess of Northumberland late in 1765 and afterward published in the *Vicar of Wakefield*.

**EDWIN BROOD.** See MYSTERY OF EDWIN BROOD.

**EDWY**, or **EADWIG** (c.939-959). A king of the English. He was the eldest son of Edmund I and succeeded his uncle Eadred in 955. Dunstan (q.v.) bitterly opposed his marrying Ælfgyfu, "because they were too near akin," and was banished from the kingdom for his pains;

but not long afterward he was recalled by the Mercians, who had revolted from Edwy and proclaimed his brother Eadgar King. Edwy was forced to share the kingdom with his brother. He died Oct. 1, 959. Consult Hodgkin, *History of England to the Norman Conquest* (London, 1906), and Oman, *England before the Norman Conquest* (ib., 1910).

**ECKHOUT**, ăk'hout, GERBRAND VAN DEN (1621-74). A Dutch portrait and historical painter and etcher. He was born in Amsterdam and studied with Rembrandt, whose composition, color, and treatment of light he imitated so well that his early pictures are sometimes confounded with those of the great master. In portrait painting Eckhout had a superior talent for expressing character. Among his best portraits are: "The Four Superintendents of the Wine Merchants Guild" (National Gallery, London); the historian Dapper (Städel Museum, Frankfurt); "A Man and a Woman in Black" (Darmstadt Gallery); Jan de Witt (Grenoble Museum). His best religious paintings include: "The Raising of Lazarus" (Berlin Museum); "The Woman Taken in Adultery" (Amsterdam Gallery); "Jacob's Dream" and the "Presentation in the Temple" (Dresden Gallery). His etchings closely resemble those of Rembrandt, whom he often assisted.

**EECLOO**, ă-klō'. A town of Belgium, in the Province of East Flanders, 11 miles northwest of Ghent (Map: Belgium, B 3). It has manufactures of lace, cotton, and woolen fabrics. It also has a considerable trade in grain. Pop., 1900, 12,897; 1910, 13,536.

**EEDEN**, ă'den, FREDERIK VAN (1860- ). A Dutch author. He was born in Haarlem, studied at the University of Amsterdam, and became a practicing physician at Bûsum. His *De kleine Johannes* (1887; 6th ed., 1900), a story of animal life, attracted great attention. Others of his works are the important poems, *Johannes Viator* (a sequel to *De kleine Johannes*, 1892), *Ellen* (1891), *De passieloose Lelie* (1901), *Enkele Verzen* (1898), and the novel *Van de Koele meren des doods* (1900). Among his dramatic works are *Ysbrand* (1910) and *Lioba* (1912).

**EKKHOUD**, ăk'hout, GEORGES (1854- ). A Belgian novelist and poet, born in Antwerp. His early poems, *Myrtes et cyprès* (1876), *Zigzags poétiques* (1877), and *Les pittoresques* (1879), were romantic. His short stories (*Kermesses*, 1884) showed a trend to realism, accentuated in his first novel, *Les milices de Saint-François* (1886), where the naïve mysticism of Flemish peasant life is finely suggested. *La nouvelle Carthage* (1888), his masterpiece, is a realistic picture of life in Antwerp. Noteworthy also are: *Les fusillés de Malines* (1890), a story of the peasant revolt against the French in 1798; *La faneuse d'amour* (1900); *L'autre vue* (1905). Consult V. Thompson, *French Portraits* (Boston, 1900).

**EEL** (AS. *ēl*, Ger. *Aal*). An elongated, serpent-shaped fish of the order Apodes (q.v.), soft-rayed, without ventral fins, and having the long dorsal fin confluent with the anal around the tip of the tail. The skin is smooth and exceedingly slimy and slippery. It may contain small scales, or scales may be entirely wanting. The vertebrae, because of the elongated form of the body, are very numerous. The best-known eels are the fresh-water eel (*Anguilla anguilla*, or *chrysypa*), belonging to the family

Anguillidæ, and the scaleless conger eel (*Leptocephalus conger*), of the family Leptocephalidæ. The common fresh-water eels, which have minute scales imbedded in the skin, occur on both sides of the Atlantic and ascend rivers and live there for the most part, returning to the sea in the autumn, or they may bury themselves in the mud during the winter. Sometimes they are dug out of the mud of river banks where large numbers of them may be found congregated together. Their activities and migrations seem to take place mostly during the night. They frequently make excursions on land in the moist grass for considerable distances, the purpose of which is not well understood.

The reproduction of the eel has excited the attention of naturalists since the days of Aristotle. In 1763 an eel-like fish, taken off the English coast by William Morris, was named *Leptocephalus*. Numerous specimens have since been obtained all over the world, and the family Leptocephalidæ has been erected to contain the various species which have been described. These creatures are thin as paper, transparent, and about 3 inches in length. It was suggested that the Leptocephalidæ are larvæ of eels, and this has been shown by Delage and by Grassi and Calandruccio, as a result of breeding experiments, to be the case, for as they developed they revealed all the characters of conger eels. Eventually Grassi showed that one of these *Leptocephali* (*Leptocephalus brevirostris*), characterized by its small size, short body, and absence of pigment, is the young or larval stage of the common eel. The discovery of Grassi (1893) was facilitated by the peculiar whirlpool currents in the Strait of Messina which occasionally bring bottom organisms to the surface, and since the young eels are found at the surface with well-known denizens of the deep sea, it is concluded that the young develop at great depths (1500 feet). The entire reproductive history of the eel may now be given as follows: Eels that descend from the fresh water to the sea do so during the months October to January, and in a sexually immature condition, as has long been known. They go to the depths and live there for eight months or more, during which time they must become sexually mature. Where the eggs are laid is not known, whether at the bottom or near the surface. From 5,000,000 to 20,000,000 eggs are laid by each female, and the eels die after once spawning, none ever returning to the coast or rivers. Larvæ are found in spring and summer. In the autumn and winter, October to February, these young eels pass from the sea into fresh water in great numbers—immigrations which have long been known as eelfares; the fish themselves, now over a year old, are called elvers. About two years then intervene between the descent of the parent eels and the ascent of their progeny.

Eels are very voracious and will eat the most varied sort of food. They grow to a length of 4 to 5 feet. Although much prejudice against them exists in certain regions, they are important food fishes and are much eaten both in Europe and America. By many they are thought to be poisonous—a notion which may have its origin in the well-known fact that eel's blood transfused into the system of higher vertebrates is very poisonous; but the same is true of the blood of other animals, though perhaps to a smaller degree. *Anguilla*, of which there are

several species, is found in all warm seas except the east Pacific. Eels are trapped by eelpots and baskets and are extensively speared. The United States census of fisheries reported the number of pounds of eels taken in 1908 as 3,358,000 valued at \$203,000, nearly all being accredited to the Atlantic coast district. Consult: Schmidt, "Contributions to the Life-History of the Eel," in *Rapports et Procès-verbaux du Conseil international*, vol. v (1906); Murray, *Depths of the Ocean* (London, 1912); Lydekker, Cunningham, Boulenger, and Thomson, *Reptiles, Amphibia, and Fishes* (ib., 1912); Smith, "Mysterious Life of the Common Eel," in *National Geographic Magazine*, vol. xxiv (Washington, 1913). See CONGER; ELECTRIC FISH; and PLATE OF EELS, CONGERS, AND MORAYS.

EE/LEE. See ILI.

EELGRASS. See TAPE GRASS; VALLISNERIA.

EELLS, MYRON (1843-1907). An American Congregational clergyman, born at Walker's Prairie, Wash. He graduated at Pacific University, Oreg., in 1866, and at Hartford Theological Seminary in 1871. After holding a pastorate at Boise City, Idaho (1871-74), he became a missionary among the Indians at Skokomish, Wash., and later pastor of the Congregational church (1876). In 1893 he was appointed superintendent of the ethnological exhibit of Washington at the World's Columbian Exposition. His publications include: *History of Congregational Association of Washington and Oregon* (1881); *History of Indian Missions on the Pacific Coast* (1882); *Ten Years at Skokomish* (1886); *Father Eells* (1894); *Reply to Professor Bourne's "The Whitman Legend"* (1902); and monographs on the Twana, Chemakum, and Clallum Indians of Washington, on the Indians of Puget Sound, and on hymns in the Chinook language. He prepared for the Smithsonian Institution many Indian vocabularies.

EELPOUT (AS. *ælepūte*, from *æl*, eel + *pūte*, pout). 1. In England, and locally in the northern United States, the burbot (q.v.). 2. The mutton fish (q.v.). 3. A catfish (*Malapterurus*). See CATFISH.

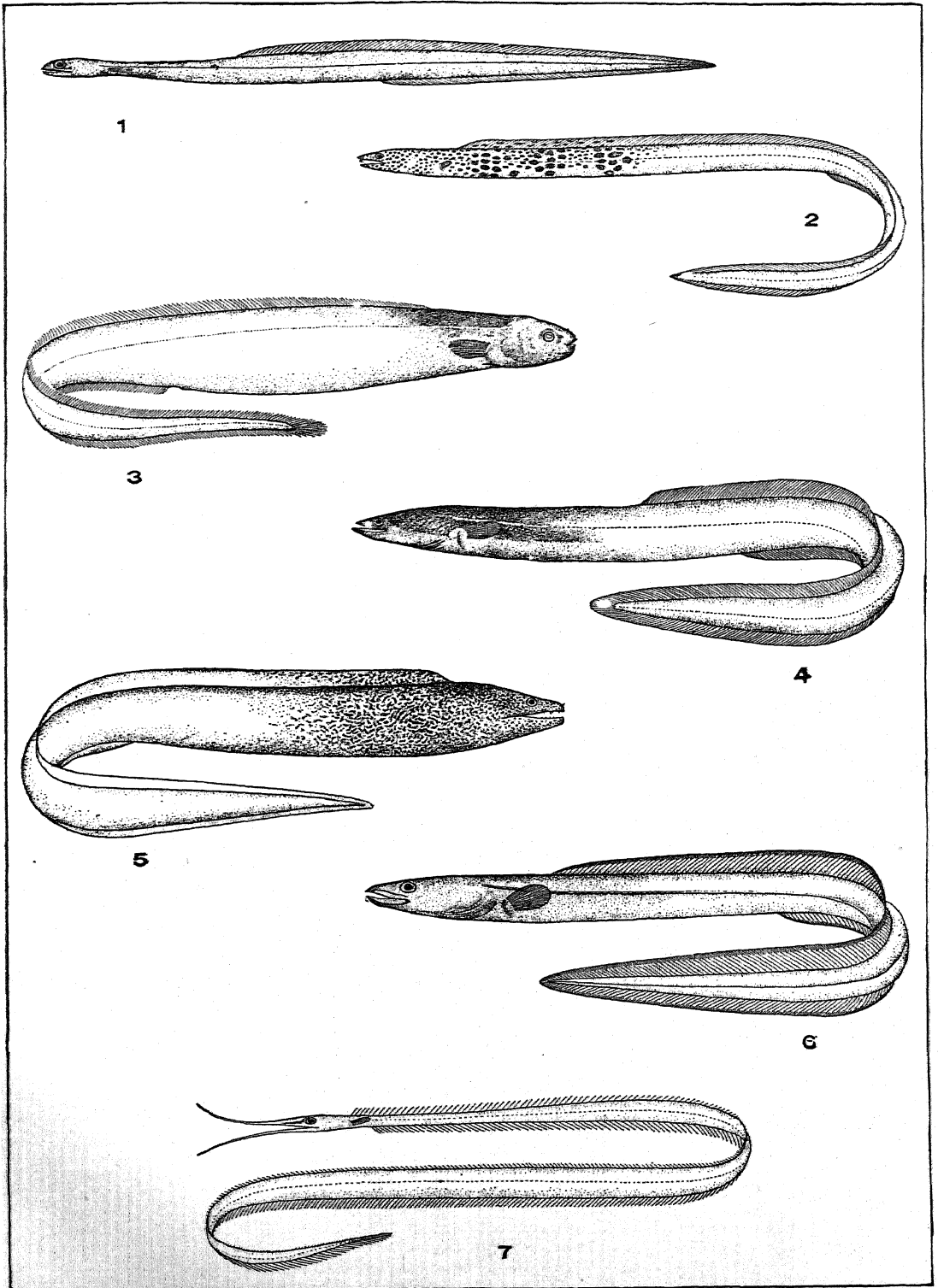
EELWORM. Any of the threadlike nematode worms of the family Anguillulidæ, as the vinegar eel. Certain species in the East Indies cause a serious disease of sugar cane called sereh, and American species are injurious to cotton, the orange, peach, and other plants, by producing galls and root knot. Consult Neal, *United States Department of Agriculture, Bulletin* 20 (Washington, 1889).

EËTION. See AËTION.

EFFECT (OF. *effect*, Lat. *effectus*, from *efficere*, to accomplish, from *ex*, out + *facere*, to do). The impression which the mind receives at the sight of a work of art without taking cognizance of the details that contribute to it. In sculpture it is the movement and general shape of the mass, which first impresses and produces the effect. In painting, effect is produced by the force of color, the balance of light and shade, and by composition. Bold sketches of their works are sometimes made by artists beforehand, for the purpose of adjusting the composition and coloring so as to produce the desired effect.

EFFENDI (Turk. *efendi*, gentleman). A term of respect among the Turks, corresponding to our Mr. or Sir, or the French *monsieur*. The title is frequently added to the name of an office

# EELS, CONGERS, AND MORAYS



1. A PELAGIC EEL (*Derichthys serpentinus*).
2. A PELAGIC EEL (*Quassiremus evionthas*).
3. DEEP-SEA PARASITIC EEL (*Simenchelys parasiticus*).
4. COMMON EEL (*Anguilla chrysypa*).
5. SPOTTED MORAY (*Lycodontis moringa*).
6. CONGER EEL (*Leptocephalus conger*).
7. SNIPE EEL (*Labichthys carinatus*).



and always follows the name with which it is used. See BASHI: REIS EFFENDI.

EFFIAT, HENRI COFFIER RUZÉ D'. See CINQMARS.

**EFFICIENCY.** A term taken into specialized use about 1908 and since then increasingly employed to designate the aim or character of a widespread movement towards betterment in both profit-making and nonprofit-making activities. This movement has found expression in two national efficiency societies, in a very large volume of literature devoted to the principles and practice of efficiency, and in a general tendency so to modify industrial and operating organizations or administrative bodies as to provide systematically for the conduct of the work in hand according to these principles and practice.

As thus adopted into modern industrial, economic, and sociological parlance, efficiency expresses a concept different from, though intermediate between, its older general sense of the quality of producing desired effects, or effectiveness, and its later mechanical sense which is the ratio of useful work performed to energy expended, or, as it is more briefly expressed, ratio of output to input.

In its newer usage efficiency is both titular and descriptive, and the meaning conveyed in its descriptive use is closer to the mechanical than to the general definition above quoted. That is, it recognizes the mechanical idea of balance between energy furnished and work returned, but it recognizes also that unpreventable losses occur in every cycle of . . . or transformation, and it does not . . . against the efficiency of the process or the agent which must work in that cycle.

The pursuit of efficiency thus becomes a diligent effort to discover and remove preventable losses and wastes so that the largest returns may be secured for the least expenditure. Its minor function may be that of increasing energy applied, or, in other words, adding to input. Its major function must be cutting off unfruitful expenditures of energy, and saving output which has been wasted on something different from the purpose desired. This distinguishes it sharply from effectiveness, which, per se, is only the achievement of result by increase of input, without any necessary consideration of the actual expenditure incurred. An effective performance may also be an efficient performance. On the other hand, an effective performance may be inefficient because it wastes resources in reaching its achievement; and an efficient performance may be ineffective because, though it conserves and applies its resources with the utmost skill, the resources available are insufficient for the work in hand.

A dynamite cartridge would be very effective in removing a gem from its matrix, but it would not be an efficient agent in the hands of the miner if it blew the stone to atoms in the process. Vice versa, a skilled man might work most efficiently to detach the stone (i.e., might accomplish all that human skill and toil are capable of) and still might be ineffective because the task exceeded his means of attack.

Efficiency is thus determined by measuring results or conduct against standards, and these standards must be fixed with full consideration of the ideals or purpose in view. For example, in taking down a historic building to be reerected elsewhere, circumspection, deliberation, careful

handling, and systematic preservation are qualities of efficiency. In removing the same building to stop an advancing conflagration, swift and utter demolition becomes in turn an efficient characteristic. In the former case the preventable losses are losses of material and of records of its position. In the latter case the preventable losses are loss of time and loss of opportunity. Efficiency therefore depends on adopting the best available methods to realize the highest attainable standards in the achievement of ideals. The first principle of efficiency is ideals, but the second is common sense, and stress is therefore laid on the qualifications available and attainable in the proposition just stated.

The concept is universally applicable, and the efficiency movement therefore appears in many spheres—religious, political, social, educational, industrial. In the first of the new societies above mentioned all these fields are represented. The second, called the Western Efficiency Society, represents especially profit-making activities. For efficiency principles applied to nonprofit-seeking institutions, the reader is referred to the *Transactions of the Efficiency Society*, vol. i, published by the society (New York, 1912).

Promotion of industrial efficiency has been sought by various workers advocating methods of many kinds, addressed sometimes to bodily, sometimes to mental, and sometimes to technical, conditions. Under the first heading fall generally the varying forms of welfare work (q.v.); under the last should be classed most of the formalized wage systems and the main portion of the scheme of scientific management (q.v.); under the second, or psychological, are grouped philosophies like the unit system (q.v.) or the committee system, which operate largely by suggestion. Also, by overlapping, we should place here some features of the wage systems which, while superficially wholly material, are found on deeper examination to derive part of their motor impulse from psychological suggestion.

In every doctrine or suggested form of practice belonging in these organized efficiency efforts, some or all of three elementary factors will be found operative. These are:

First, standardization, which means broadly determining the best way of doing the work in hand under the best conditions that can be established in the circumstances, and providing the means for thus doing it with the least loss or waste. This is like clearing the course and preparing the track for the runner so that all his expended energy may carry him towards the goal and none be wasted in overcoming obstacles.

Second, instruction to the worker in performing the task by this best attainable (i.e., standardized) way. This is like training the runner.

Third, incentive—a reward proportioned to individual efficiency to persuade the worker to accept the prepared conditions and the expert guidance and thus to make the most of himself and of the opportunity. This is like the prize or record won by the runner of the race.

The principal modern systematized attempts to increase industrial efficiency are treated at greater length under separate headings, to which references are given in the short comparative statement below. They codify practice which in many cases is much older, but which had not formerly been identified and reduced to expression. The first to attract wide attention in America was the premium plan (q.v.), described by F. A. Halsey in 1891. In this the standard is merely

past performance, and the incentive is half the wage value of any time saved by the worker. The factor of instruction does not appear, the assumption being that the worker already has more knowledge than he is using and will release this reserve store of information and skill under the incentive of the added wage premium.

Next (1896) came the F. W. Taylor differential piece rate. (See SCIENTIFIC MANAGEMENT; WAGES.) In this standardization was still further emphasized. Fixation by careful study of the best time in which the work could reasonably be done replaced mere record of the time in which it formerly had been done. Standardization of tools and fixtures as well as of time was suggested, though not emphasized. Instruction was not clearly provided for, but was implied to a greater extent than in the premium plan. Incentive took the form of higher pay per piece for work finished in the standard time than for work taking a longer time than standard.

Five years later (1901) followed H. L. Gantt's task work with bonus (q.v.). Accepting and amplifying all that had been done in standardization of task and time, this doctrine added largely to standardization of conditions and was foremost in emphasizing and providing for individual instruction to the worker in the performance of the standard task. Incentive was given the form of a large percentage increase to the day wages of the conforming and successful worker.

Shortly thereafter (1903) appeared Taylor's *Shop Management*, setting forth the system now titularly styled scientific management (q.v.). Here standardization is extended to the limit, governing not only task, time, and workers' movements, but organization, administration, and management.

A new form of organization and a new practice of administration, known as functional management, are devised for the purpose, first, of advance planning, and, second, of constant supervision of every job. Not only the task, but the method of assigning the task and of superintending the task, even of naming the task and the appliances, are thus standardized. The incentive may be either the differential piece rate or the bonus—in either case a substantial increase of pay to the man who cooperates with the management in reaching the standard. This system is sometimes styled by its disciples ultimate management. It is intensive in its treatment of the material factors of the production problem and in its specification of exact ritual for every detail.

In the philosophy formulated by Harrington Emerson in 1908 and first known as the efficiency system appears a similar concept of the necessity of standardizing the management as well as the men's work. The underlying idea, however, differs radically from Taylor's functional separation of the managing organization into two parts, each again subdivided into four functional activities. Emerson leaves the line organization intact, but brings in an expert staff to guide and counsel the line in all its more important duties and problems. His standardization of tasks is reached not so much by building up from analyzed elements as by correcting actual performance by eliminating preventable wastes. His incentive plan, instead of waiting until the man fully achieves a task, begins to encourage him by some small bonus as soon as

he has advanced two-thirds of the way to standard achievement and increases the reward on a rising scale as perfection is more and more nearly approached. More significant, however, in this philosophy is the categorical recognition of psychical qualities as necessary to efficiency in practice. Twelve principles are acknowledged as necessary to efficient guidance and conduct of any enterprise. They are: ideals; common sense and judgment; competent counsel; discipline; the fair deal; reliable, immediate, and accurate records; planning and dispatching; standards and schedules; standardized conditions; standardized operations; written standard-practice instructions; efficiency reward.

Last, but by no means least interesting are the theories and practice dependent chiefly on psychological suggestion. Such are the committee system (see LEGISLATIVE MANAGEMENT) of Charles U. Carpenter and the unit organization (q.v.), of Major Charles De Lano Hine. In both of these, with almost nominal outward change in organization, with little or no change in equipment, and perhaps none whatever in wage matters, the men in whose power it lies to increase the efficiency of operation are given a new vision and a new interpretation of their responsibility and their relation to the undertaking as a whole. This may be done, as in the Carpenter system, by assignment to committees with stated conferences. It may be done, as in the Hine system, by a change of title and of nominal province without a change of specialized interest. In either case the same great factors of standards, incentive, and (to less degree) instruction can be discerned though under much subtler forms.

In general, the more specific and detailed and the more highly formalized any scheme for the promotion of efficiency is, the more limited the range of situations to which it is applicable, and the more it tends towards a selective sifting out of standard individuals for some special work and the elimination of the unfit. On the other hand, broad and elastic measures for the promotion of fundamental principles are adaptable to a wide range of cases and to shifting conditions and tend towards a general raising to some extent of the efficiency of all who come under their influence. Each of these effects is important. The specific measures to be adopted in any given case and the steps by which they should be applied are matters for determination by a specialist.

**Bibliography.** H. Emerson, *Efficiency as a Basis for Operation and Wages* (3d ed., New York, 1912); Schulze, *The American Office: Its Organization, Management, and Records* (ib., 1913); Kimball, *Principles of Industrial Organization* (ib., 1913); Frank Koester, *The Price of Inefficiency* (ib., 1913); Hugo Münsterberg, *Psychology and Industrial Efficiency* (Boston, 1913); N. A. Briscoe, *Economics of Business* (New York, 1913); H. Emerson, *Twelve Principles of Efficiency* (ib., 1911); W. D. Scott, *Increasing Human Efficiency in Business* (ib., 1912); J. Goldmark, *Fatigue and Efficiency* (ib., 1912).

**EFFINGHAM.** A city and the county seat of Effingham Co., Ill., 101 miles east by north of St. Louis, Mo., on the Vandalia, the Wabash, and the Illinois Central railroads (Map: Illinois, G 7). There are situated here colleges of photography and of photo-engraving. The chief industrial establishments are a milk-condensing



plant and a canning factory. Settled about 1850, Effingham was incorporated as a city in 1869. Pop., 1900, 3774; 1910, 3898.

**EFFLORESCENCE** (from Lat. *efflorescere*, to blossom, from *ex*, out + *florescere*, inchoative of *florere*, to bloom, from *flos*, flower). A phenomenon exhibited by many crystalline compounds when exposed to the air; the compounds lose their water of crystallization and change into pulverulent masses. The white incrustation that frequently shows itself on the walls of buildings is an example of efflorescence.

**EFFORT** (OF. *effort*, *esfort*, Fr. *effort*, It. *sforzo*, from ML. *effortiare*, to strengthen, from Lat. *ex*, out + *fortis*, strong). Primarily effort, or strain, is a sensation which is derived from the tendons. When we are active, as in wrestling, pushing, pulling, lifting, we term it effort, or exertion; when we are passive, as in supporting a weight, or standing for a long time on one leg, we term it strain. The quality, however, is the same throughout.

The term "effort" is also used to express the conscious strain which is present in ratiocinative thinking, as in solving a problem. This kind of effort is sometimes called "mental effort" or "mental work"; although the tendinous sensations accompanying severe muscular exertion are no less mental and, as conscious experiences, are the same in kind as the effort realized in "hard" work in an attempt to remember, or in "deliberation" to decide on a course of conduct. The existence of effort has been used as an argument in favor of a peculiar activity of consciousness, as indicating that "mental force" is expended in voluntary action; but it may also be looked upon as simply a complex of intensive organic sensations strongly toned with unpleasantness. In this case the "work" is performed by the physiological processes accompanying effort. The prominent affective side of the experience is indicated in the common phrase "feeling of effort." Effort was for a long time held to be an essential part of the innervation sensation (q.v.); i.e., the sensation which was said to accompany the outflow of energy from the brain to the motor nerves. But this position has now been abandoned by most psychologists. See ATTENTION; CONATION. Consult Külpe, *Outlines of Psychology* (London, 1909), and Titchener, *Text-Book of Psychology* (New York, 1910).

**EFFUSION** (Lat. *effusio*, from *effundere*, to pour out, from *ex*, out + *fundere*, to pour). A term applied to the free outflowing of a gas through a pinhole, the resistance to the outflow being very small. The velocity of effusion was found by Graham in the case of different gases to be *inversely proportional to square roots of their densities*. The principle was applied by Bunsen to the determination of the relative densities of gases and hence also of their molecular weights. A modification of Bunsen's apparatus is now widely used in gas factories for rapidly testing the quality of gas. The amount of gas required for an experiment being very small, Debièvre was able to employ the effusion method for determining the molecular weight of radium emanation.

Quite different from effusion is the phenomenon of *transpiration of gases*, i.e., the outflow of gases through long capillary tubes offering considerable resistance to their passage. The rate of transpiration of a gas depends on four factors: (1) the nature of the gas; (2) the density of the gas; (3) the pressure under which it is

being expelled; and (4) the length of the tube. The first of these factors of course remains the same if one and the same gas is experimented upon under different conditions. The rate of transpiration is then found to be *directly proportional to the density as well as to the expelling pressure and to be inversely proportional to the length of the tube*.

The phenomena of effusion and transpiration are essentially different from those of diffusion. In the former the gases move *in masses*; in diffusion they move *by molecules*. See DIFFUSION.

**EFT**, or **EVET** (AS. *efete*). A term formerly applied popularly and scientifically both to lizards and newts. It is now synonymous with newt, and in the United States red eft, or evet, is a local name of the spotted newt (*Diemyctylus miniatus*). See NEWT.

**ÉGALITÉ**, á'gá'lé'tá'. See ORLÉANS, HOUSE OF.

**E'GAN**, MAURICE FRANCIS (1852- ). An American scholar, born in Philadelphia and educated at La Salle College. In 1878 he became professor of English literature at Georgetown College, but subsequently he was successively associated with *McGee's Illustrated Weekly*, the *Catholic Review*, and *Freeman's Journal*, of which he was chief editor from 1881 to 1888. He was professor of English literature at the Catholic University, Washington, D. C., from 1895 to 1907, when he resigned to accept the post of United States Minister to Denmark. In 1913 he declined the ambassadorship to Austria-Hungary, offered him by President Wilson. His publications include a translation of Coppée's *Pater; That Girl of Mine* (1879); *Preludes*, a collection of poems (1880); *Songs and Sonnets* (1886); *The Life around Us*, a collection of tales (1886); *Lectures in English Literature* (1889); *The Disappearance of John Longworth*; *St. Martin's Summer* (1905); *The Ghost in Hamlet, and other Essays* (1906); *Amélie in France* (1912); *Everybody's St. Francis* (1912); *Notes on Agricultural Conditions in Denmark* (1913).

**EGAN**, PATRICK (1841- ). An Irish-American politician, born in County Longford, Ireland. He became the head of an extensive flour and grain business in Dublin. An ardent Nationalist, he took an active part in the Home Rule movement in 1871 and in the organization of the Irish Land League, of which, in 1879, with Justin McCarthy and Biggar, he was one of the first trustees and the treasurer. In 1880 he was tried in Dublin for conspiracy and sedition, and after his acquittal he removed to Paris and in 1883 to the United States, settling in Lincoln, Neb. From 1884 to 1886 he was president of the Irish National League of America. His testimony before the Parliamentary Commission in 1889 brought about the collapse of the London *Times's* case against Parnell. He took an active part in the Blaine campaign of 1884 and for his services in the campaign of 1888 was made Minister Plenipotentiary to Chile. There his active advocacy of the cause of Balmaceda (q.v.) brought upon him severe criticism. In the campaigns of 1896 and 1900 he left the Republican party on the free-silver issue and campaigned for Bryan.

**EGAN**, PIERCE (1872-1849). An English writer on sports. He was born in London and by 1812 had attracted considerable attention there by his articles in the newspapers on country sports. A series of articles describing the

amusements of sporting men in town which were published under the title *Life in London; or, the Day and Night Scenes of Jerry Hawthorne, Esq., and his elegant friend, Corinthian Tom, Accompanied by Bob Logie, the Oxonian, in their Rambles and Sprees through the Metropolis* (1821), also became very popular among Londoners. This book was illustrated by George and Isaac Cruikshank, was one of Thackeray's early favorites, and is believed to have furnished the material for Dickens's *Pickwick Papers*. Several imitations and pirated reproductions of this famous work appeared. In 1824 he began to edit *Pierce Egan's Life in London and Sporting Guide*, a weekly newspaper later combined with *Bell's Life in London*. His other published works include: *Boxiana* (in several volumes, 1818-24); *The Life of an Actor* (1824); *Pierce Egan's Book of Sports and Mirror of Life* (1832); *The Pilgrims of the Thames in Search of the National* (1838).

**EGAN, PIERCE** (the younger) (1814-80). An English novelist and artist. He was born in London and at an early age became successful as an illustrator. He is best known, however, as a novelist. His extravagant yarns were exceedingly popular for a time, as also were his numerous contributions to the "penny-dreadful" papers of the day. Among his stories are: *Wat Tyler* (1841); *Robin Hood* (1842); *Snake in the Grass* (1858); *Etc; or, the Angel of Innocence* (1867); *Love Me, Leave Me Not* (1860).

**EGAÑA, á-gü'nyá, JUAN** (1769-1836). A Spanish-American juriconsult, statesman, and author. He was born in Lima, Peru, and was educated at the College of Santo Toribio, where he was made a professor of philosophy at the age of 16, and professor of theology and law at 21. He practiced law at Santiago, Chile, whence he petitioned the court of Spain for the establishment of a chair of eloquence at the University of San Felipe. The chair was established, and he won it in public contest. He became one of the leaders of the revolution of 1810 and was elected a member of the first Chilean Congress. After the defeat of the Chilean army at Rancagua, in 1814, he was imprisoned by the Spaniards on the island of Juan Fernández, but was liberated through the victory of San Martín at Chacabuco in 1817, when he became professor of belles-lettres at the National Institute and member of the Board of Education. Upon the fall of O'Higgins in 1823, Egaña became President of the Constituent Congress of Chile; and the plan of a constitution sanctioned by this congress was his work. He was considered one of the best writers of his day, and his literary works, published in 10 vols. include poems and educational textbooks, as well as numerous essays on legal, political, and various other subjects. His *Cartas Pehuénchas* were translated into English by their author, under the title of *Pehuénchan Letters* (1819).

**EGBERT, or EGGBERHT** (?-839). A king of the English. He was the son of Eahlmund, a king of Kent, and was descended from the early kings of the West Saxons. In his youth he was compelled to flee from England to avoid the hostility of Beorhtric, King of Wessex, and took refuge at the court of Charles the Great. Here he remained probably for some 13 years, until, in 802, he became King of the West Saxons. For the first 13 years of his reign nothing is known of his acts. In 815 he conquered and laid waste Cornwall. Between 825 and 829 he

subdued all the other kings in England, beginning with the ruler of Mercia, the most powerful rival of Wessex, and was recognized as Bretwalda. Kent, Sussex, and Essex were added to his kingdom and were ruled by his sons or nobles as underkings. Northumbria, Mercia, and East Anglia were permitted to retain their independence, acknowledging the supremacy of the West Saxon King. For the first time Egbert brought all of the English peoples under one overlord. In his last years he had to contend against the Danes, by whom he was defeated in 835, and over whom he was victorious in 837. Consult *Anglo-Saxon Chronicle* (where the dates, however, are given wrongly); Green, *The Making of England* (London and New York, 1881); id., *The Conquest of England* (ib., 1883); Hodgkin, *History of England to the Norman Conquest* (London, 1906); Oman, *England before the Norman Conquest* (ib., 1910).

**EGBERT, JAMES CHIDESTER** (1859- ). An American classical scholar and educator, born in New York City. He graduated in 1881 at Columbia University, where he afterward held tutorships in Greek (1885-87) and Latin (1888-95), was adjunct professor of Latin from 1895 to 1900, then professor of Roman archaeology and epigraphy and after 1906 professor of Latin. In 1902 he became in addition director of the summer session of Columbia University and later director of its system of extension teaching. His works include an edition of *Macmillan's Shorter Latin Course* (1892); *Cicero de Senectute* (1895); *Introduction to the Study of Latin Inscriptions* (1895); *Livy xxi and Selections from xxi to xxx* (1913). He contributed to the NEW INTERNATIONAL ENCYCLOPEDIA.

**EGEDE, á'ge-de, HANS** (1686-1758). The first missionary to Greenland. He was born in Senjen, Norway, was educated at the University of Copenhagen, and was settled as a Lutheran pastor at Vaagö from 1706 to 1717. A study of the Norse chronicles awakened in him a desire to visit Greenland and convert to Christianity the descendants of the old Northmen, who he believed still lived there. In 1721, having obtained the support of the Danish government, he sailed for Greenland, but, on arriving, he found that the former Norse colonists had entirely disappeared. However, he resolutely turned his attention to converting and civilizing the Eskimos. Though compelled to endure great hardships and privations, he founded the Colony of Godthaab, converted many of the natives to Christianity, and established commercial relations with Denmark. In 1734 he was forced by ill health to return to Copenhagen, where he was for 6 years principal of a seminary in which workers were trained for the Greenland mission. In 1740 he became superintendent or bishop of the mission. He described his work in Greenland in *Det gamle Grönland's nye Perturbation* (1741) and is the author of a work on the natural history of Greenland, which has been translated into four languages.—PAUL EGEDE (1708-89), his son, succeeded him in the Greenland mission and later in the bishopric, translated the Gospels into the Greenland language and compiled a grammar and dictionary for the use of the missionaries and colonists. Consult Hamilton, *History of the Missions of the Moravian Church* (Bethlehem, Pa., 1901).

**EGELHAAF, á'gel-háf, GOTTLÖB** (1848- ). A German historian; born at Gerabrom

(Württemberg). He studied at Tübingen, in 1895 became head of the Karls gymnasium at Stuttgart and in 1901 lecturer in the technical institute there. Important among his publications are: *Kaiser Wilhelm I* (3d ed., 1888); *Deutsche Geschichte im Zeitalter der Reformations* (3d ed., 1893); *Geschichte der neuesten Zeit* (4th ed., 1912). He also wrote a popular manual, *Grundzüge der deutschen Literaturgeschichte* (22d ed., 1913).

**EGER**, ä'gër (Bohemian *Cheb*). A town of Bohemia, situated on an eminence 1450 feet above sea level, at the foot of the Fichtelgebirge, on the Eger, 66 miles west-northwest of Pilsen (Map: Austria, C 1). The chief building of interest is the Stadthaus, or town hall, in which, on Feb. 25, 1634, Wallenstein was assassinated. The hall contains a museum of local antiquities, pictures, and relics of the famous general. In an angle of the old fortifications above the river stand the ruins of the Imperial castle built by Frederick Barbarossa. From their midst rises a square black tower, constructed of blocks of lava. The graceful double chapel is worthy of notice. The Schillerhaus, in which the German poet stayed while writing *Wallenstein*, still stands. The institutions of the town include a teachers' college, an agricultural school, and an almshouse. Its manufactures include woolen, cotton, and other textile fabrics, chemicals, carpets, machinery, and leather goods. About 4 miles to the north of Eger and reached by a broad avenue is the watering place of Franzensbad (q.v.). Pop., 1900, 23,665; 1910, 26,619, mostly Germans. Eger was probably founded at the beginning of the twelfth century and came into the possession of Bohemia about 1320. The city suffered greatly in the wars of the Hussites, the Thirty Years' War, and the War of the Austrian Succession. Consult Drivok, *Altère Geschichte der deutschen Reichstadt Eger* (Leipzig, 1874), and K. Siegl, *Die Kataloge des Egerer Stadtarchivs* (Eger, 1900).

**EGER**, äg'ër. See ERLAU.

**EGERIA** (Lat., from Gk. *Ἑγρία*). One of the Italian goddesses of streams or springs. She appears in Vergil's *Æneid*, vii, 763 ff., as the nymph of the stream in the grove of Diana at Aricia. In Livy, i, 19, 21, and Juvenal, iii, 12, she is represented as dwelling near the Porta Capena, at Rome, near the spot where Numa (q.v.) consecrated a grove to the kindred goddesses called Camenæ. Egeria is best known as the divine mistress or wife of Numa, whose inspiration and advice guided him in his reorganization of the ritual of the Roman state. According to Ovid, *Met.*, xv, 479-551, Egeria, after the death of Numa, went to Aricia, and, there, by reason of her ceaseless lamentations, was changed by Diana into a spring.

**EGERTON**, ej'ër-ton, FRANCIS. See BRIDGE-WATER.

**EGERTON**, FRANCIS, EARL OF ELLESMERE. See ELLESMERE.

**EGERTON**, HUGH EDWARD (1855- ). An English historian, educated at Rugby and at Corpus Christi, Oxford. In 1886-1906 he was a member of the managing committee of the Emigrants' Information Office, and in 1905 he was appointed at Oxford Beit professor of colonial history, his special field. He wrote: *A Short History of British Colonial Policy* (1897; 3d ed., 1910); *See Stamford Raffles* (1900); *Origin and Growth of the English Colonies* (1902); *Canadian Constitutional Development*,

with Grant (1907); *Canada under British Rule* (1908); *Federations and Unions within the British Empire* (1911).

**EGG** (AS. *æg*, Icel. *egg*, OHG. *ei*, Ger. *Ei*; connected with OChurch Slav. *aye*, *yaye*, Lat. *ovum*, Gk. *óvov*, *óvov*, *egg*). The present article proposes to consider the external characteristics, qualities, and utilities of the eggs of animals, and more especially of birds, leaving to the articles EMBRYOLOGY, REPRODUCTION, ETC., their biological relations and development. All animals except Protozoa produce eggs, which are essentially single cells of protoplasm, containing a nucleus in which rests the potentiality of life, plus, in most cases, food material and an integument. Eggs may be produced singly or in very small numbers at long intervals, or frequently and in great numbers; they may be so minute as to be invisible to the unaided human eye or may exceed a foot in diameter; and in relative size, as compared with the parent, they may be nearly a quarter as large or less than a millionth; they may never leave the parent except as waste matter, or may be extruded, either before or after fertilization; finally, those which are "laid" may be cast out wholly naked to take an infinitesimal chance of survival, or may be more or less well secured against harm by protective coverings, or even become objects of care and protection on the part of the parents.

**Eggs of Birds.** The eggs of birds will be considered first, because they are typical, familiar, and of most interest to the general reader. They are the largest, relatively to the size of the parent, of any in the animal kingdom, owing to the fact that the embryos must reach a higher degree of maturity (and bulk) before hatching than among inferior classes of animals. The egg originates in the ovary, where, as the breeding season approaches, a number of them become greatly enlarged and one by one break loose from the ovarian membranes and begin to descend the oviduct. They are at this time simply spheres of yolk surrounding a small quantity of germinal protoplasm (the nucleus of the original cell), which appears on the surface of one side, as the "tread" of popular speech (see ALLANTOIS; EMBRYOLOGY), and covered with an almost imperceptible membrane, the vitelline membrane, formed from the protoplasm of the egg itself. Yolk, or deutoplasm, is a granular, fatty, nutritive material or highly compact food, stored in the egg for the nourishment of the young. It is of two kinds, white and yellow. The white yolk forms a thin film over the surface of the yellow yolk, and passes also under the germinal vesicle, where it forms a sort of bed, and from this point extends downward to the centre of the yellow yolk. The egg is passed into the sac-like mouth of the oviduct and then descends into the oviduct itself, where it is, or may be, fertilized, and along which it descends in a slow spiral course.

Here the yellow ball begins to receive its outer coverings, the first of which is the "white," or albumen, which is poured out from glands, and consists of about 86 per cent of water, 12 per cent of proteids, 1.5 per cent of fat, and a little salt. This "white of the egg" is formed in concentric layers (as may be seen in a hard-boiled egg), the innermost of which is somewhat tenacious, and is drawn out by the spiral rotation of the egg in its progress into threads at the opposite poles. "These threads," writes Coues, "which become twisted in opposite directions,

... are called *chalazæ*; they are the 'strings' rather unpleasantly evident in a soft-boiled egg, but serve the important office of mooring and steadying the yolk in the sea of white by adhesions eventually contracted with the membrane which immediately lines the shell. They are also intrusted with the duty of ballasting, or keeping the yolk right side up. For there is a 'right' side to the yolk ball, being that on which floats the cicatrice, or 'tread.' This side is also the lightest, the white yolk being less dense than the yellow; and the *chalazæ* are attached a little below the central axis. The result is that, if a fresh egg be slowly rotated on its central axis, the tread will rise by turning of the yolk ball in the opposite direction, till, held by the twisting of the *chalazæ*, it can go no further: when, the rotation being continued, the tread is carried under and up again on the other side, resuming its superior position." The earliest embryologists (e.g., Fabricius ab Aquapendente, 1600) attached considerable importance to the *chalazæ* and to certain white particles, the *granulines*, contained in them, because these structures were erroneously supposed to give rise to the embryo bird.

**The Eggshell.** The deposits of albumen are overlaid, when the egg arrives at the constricted neck of the uterus, by a membrane secreted by the lining of the oviduct and formed of albumen mixed with felted fibres. This is the egg pod lining the shell. It is double, and by the separation of its two layers at one end the air chamber is formed. The egg, now five or six hours old in the case of the common fowl, passes on into the uterine dilatation of the oviducts, where it rests for about 20 hours and receives from numerous villi in the lining of the walls an even coating of a viscid fluid thickly imbued with lime, which rapidly crystallizes and compacts into a calcareous, somewhat felted shell around the whole egg. This is attached at many separate points to the shell membrane, leaving numerous minute spaces between them filled with air through pipelike interstices in the shell. "Besides this mammillary and porous layer, the shell of most birds," according to Newton, "possesses a cuticular layer. This outermost layer is the most variable part of the shell; it is apparently structureless, either very poor in calcine salts and in this case smooth and shiny, or considerably infiltrated with calcareous matter and then exhibiting the well-known chalky and often rough appearance of the eggs of the ani, cormorants, grebes, and flamingoes. Even when well developed, this cuticular layer is always extremely thin. In the ostrich and in rhea it is hard and brittle, like the glaze of pottery; in the common fowl and turkey it is parchment-like; in auks and apparently in gulls it is absent. The cuticle is spread over the whole surface of the egg and into the pits or surface ends of the air canals, which are therefore closed when such a cuticle is present. The latter, however, readily admits the passage of air when dry, but when wet or moist is impermeable to air." The very great differences observable in the surface of eggs, from rough and pitted to enameled or polished or transparently brilliant, is due to the varying crystalline structure of the shell. This has been very thoroughly worked out by German microscopists, whose extensive investigations are recorded in the *Journal für Ornithologie* for 1871 and subsequently, and who have shown that a

well-defined type of shell structure belongs to each of various groups. Further information is given in the *Zoologischer Anzeiger* (1885-87)

The porosity of the shell is needful, of course in order to admit air to the embryo; and the pores are large enough to admit also some bacteria, so that after a short time eggs not energized by vital processes become corrupt and rotten. The various preservative processes that have been attempted to prevent decay depend for their success upon the complete exclusion of bacteria and only succeed when they are begun before any infection has been received and when they absolutely close all the pores of the shell. This can best be done by soaking in limewater in effect reinforcing and completing the natural shell.

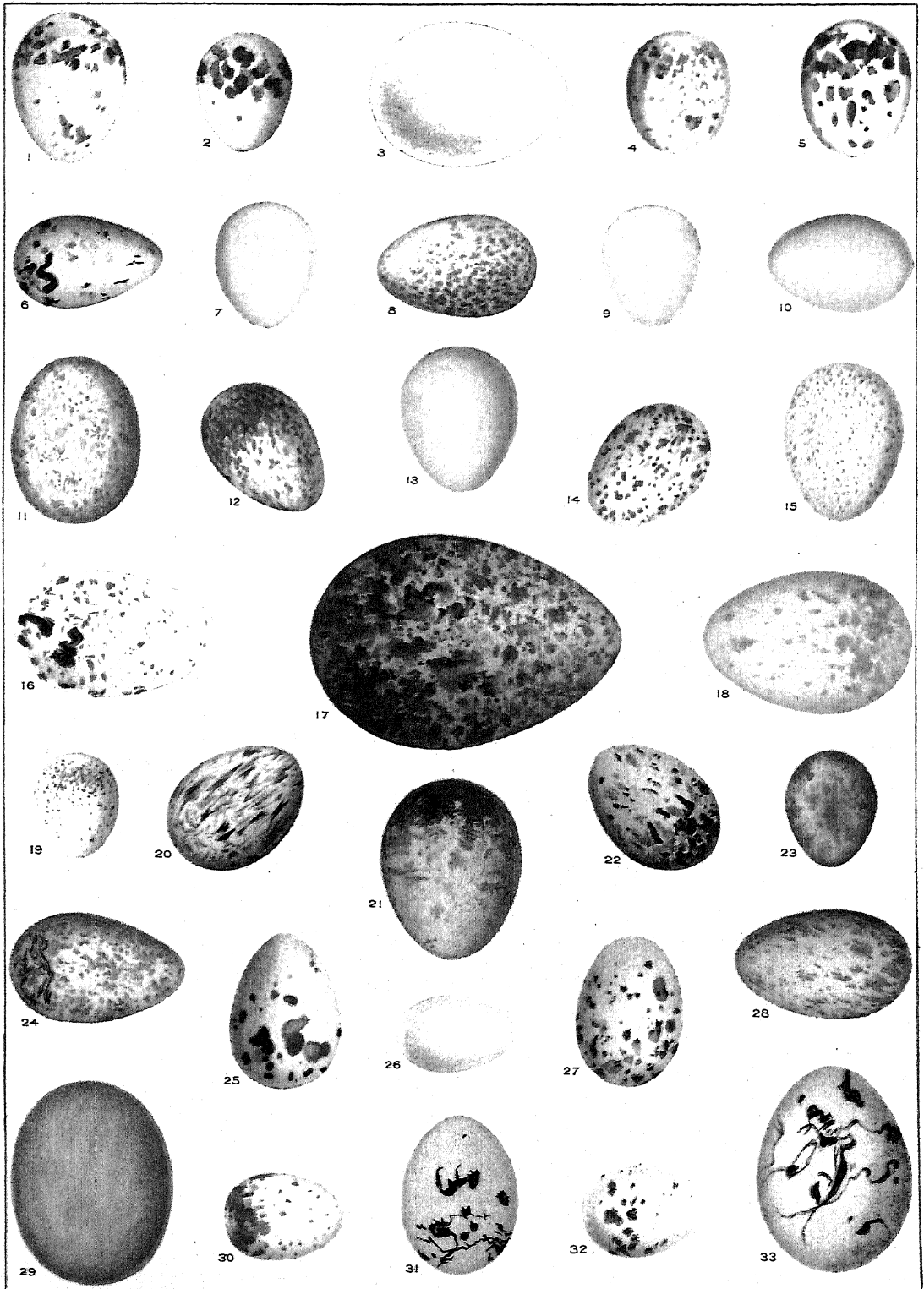
**Number and Size of Eggs.** The number of eggs that constitute a clutch, or set, is fairly uniform with each species, but differs greatly among different species. Pelagic waterfowl and the larger birds of prey usually lay only one egg, rarely more than two; many game bird and lake and river fowl lay a dozen; woodland and field birds average five, though in some species two or three are prevailing numbers, and in others, e.g., titmice, the clutch may consist of 10 eggs. The number of eggs laid, except in cases correlated with peculiar circumstances in life history, are so nearly constant among species of similar habit and bear so evident a relation to the average comparative danger to which the species is exposed that naturalists recognize evidences of a seeming general principle which governs the size of the brood, and, if any peculiarity should appear in the nesting or the rearing habits that might accrue to the welfare of the individual species, it is offset by a reduced reproductive power.

Another noteworthy fact is that great diversity exists in the size and weight of eggs as compared with the size and weight of the mother bird. Hewitson states, e.g., that the raven and guillemot are of about equal size, but their egg vary as four to one, the latter's being as big as those of an eagle. Still more remarkable for disproportionate bigness are the eggs of the Australian mound birds, which measure  $3\frac{1}{4}$  by  $2\frac{1}{2}$  inches, though the hen is only about the size of a common fowl; and of the extinct moas, emu, and the existing kiwis (*Apteryx*), that of one of the kiwis weighing nearly one-fourth as much as the hen which produces it. Much individual variation exists, and several factors seem to enter into the explanation; but in general eggs much larger than ordinary, relatively to the size of the mother, belong to birds whose precocial young will receive little or no help and care from their parents after birth, and hence must remain within the protection of the egg until they are considerably advanced toward maturity. This requires a very much larger egg

#### TYPES OF EGGS OF AMERICAN SONG BIRDS.

1. Flycatcher, olive-sided.
2. Flycatcher, vermilion.
3. Flicker, golden-shafted.
4. Sparrow, Henslow's.
5. Flycatcher, scissor-tailed.
6. Oriole, orchard.
7. Phoebe Say's.
8. Cowbird.
9. Indigo bird.
10. Dickcissel.
11. Nighthawk, Texan.
12. Swamp sparrow.
13. Veery.
14. Chewink.
15. Thrasher.
16. Meadow lark.
17. Raver.
18. Nutoracker.
19. Wren, Bewick's.
20. Flycatcher, great crested.
21. Jay, California.
22. Flycatcher, ash throated.
23. Finch, Lincoln's.
24. Blackbird, yellow-headed.
25. Flycatcher, scissor-tailed (variety).
26. Flycatcher, least or Chebec.
27. Kingbird, Western.
28. Grosbeak blackheaded.
29. Cuckoo, yellow-billed.
30. Seedeater, blackfaced.
31. Blackbird, red-winged.
32. Flycatcher, Acadian.
33. Grackle, boat-tailed.

# EGGS OF AMERICAN SONG-BIRDS







than is needed for the early-born, parent-supported, altricial birds, since a much greater quantity of food (yolk) must be stored up for them, and they must have room to grow. It is plain that few such eggs can be produced from the resources of the mother's organization, and, as a matter of fact, these huge eggs are laid singly; as a rule, relatively large eggs mean few in a brood.

**Shape.** In shape birds' eggs are rarely spherical, though the contained yolk is always so, but ordinarily are ovoid, being much larger at one end than the other, and often nearly conical; while some are oblong, having a decided length but no excess of thickness at either end. Eggs laid in holes or deep, cuplike nests, where they cannot fall out, are likely to be spherical or ovoid; while those laid upon the ground, with little or no nest, are usually conoid, and likely to be large for the size of the bird. This shape gives them two points; the first point enables them to lie more easily in the nest, the second points towards a common center, and the points are easily covered by the brooding bird; and, second, in the case of eggs, like those of guillemots, which are laid upon bare ledges of sea cliffs with no enclosing nest, the conical shape prevents their being easily rolled or blown away when uncovered, because when moved they will tend to gyrate upon their points and not roll away. Among the services which the eggshell performs, the foremost is the protection of the embryo from injurious changes of temperature and from too much light. See GROWTH.

**Color.** Birds' eggs may be said to be normally chalky white, but in a great number of groups they are colored. The color may be a uniform tint over the whole surface, or a tint with markings; or simply dots, spots, streaks, or blotches of one or more hues on an otherwise colorless shell. These colors exude from uterine glands in the form of pigment corpuscles deposited with the forming shell and stain its deeper as well as its more external layers. Many of the variations in tint of the spots are thus due simply to their being overlaid by more or less transparent material, but certain real colors exist. This matter was studied by H. C. Sorby by the methods of spectrum analysis described by him in the *Proceedings of the Zoological Society of London* for 1875. He learned that the coloring matters in eggshells are connected with hemoglobin and the bile pigments and are definite physiological products. He reported seven of these products as follows:

1. *Oörhodeine*. The most important of the colors, present in almost all eggs, which gives an effect when alone of brownish red. The spectroscopic shows so close a similarity between this and the product of the decomposition of the red corpuscles of the blood as to make it probable that they are physiologically identical and derived from the same source. Such red-brown eggs as those of the grouse are mainly tinted by this material.

2. *Oöcyan*. A fine blue.

3. *Banded oöcyan*. Also a fine blue, but giving a different spectrum. A chemical similarity is apparent between the two oöcyans and the pigments of the bile, and they must be regarded as derived by separate physiological processes from the same source.

4. *Yellow oöxanthine*. Clear yellow; unstable and liable to fade.

5. *Rufous oöxanthine*. Reddish yellow.

6. *A substance giving narrow absorption bands in the red*. Probably brown.

7. *Lichenozanthine*. A brick-red substance, apparently identical with a coloring matter common in plants, especially in lichens and fungi.

The mixture of these pigments in various ways gives the varied colors observed in eggshells. Thus, the nightingale's egg has been shown to be colored with a mixture of oörhodeine and oöcyan; while all the varying greens and blues so common as ground tints are due to varying mixtures of oöcyan with oöxanthine, and such are likely to fade or to change color when long exposed to the light.

An interesting feature in this connection is that not only the state of health, but the state of mind of a bird, may affect the colors of its eggs, as Hewitson long ago recorded.

**Theories of Color-Markings on Eggs.** The reason for the many and various colorings of birds' eggs has been a favorite field of speculation and many ingenious theories have been constructed to explain the matter, from the pious musings of Sir Thomas Browne to the present day. The most important thesis is that advanced by Wallace and enlarged by Poulton, who attempt to show that birds' eggs are examples of protective mimicry in color, as the result of natural selection. Impartial examination shows, however, that only in a minority of cases does the theory of adaptive coloration seem to be adequate and not open to serious interference from other explanations or contradictions: such favorable cases are those of the nightjars, game birds, shore birds, coots, and some other ground builders making scanty nests, whose eggs certainly do closely simulate the beach, or leaves, or marsh grass upon which they lie. They are certainly very difficult to see, especially for human eyes; but most of the despoilers of birds' nests are not human, but brute foes which, for the most part, depend less upon their eyes than upon their noses to discover what they seek, and most of which go about by night rather than by day. Against such foes color is of small importance among the factors of safety. It is quite probable that in the cases above mentioned the inconspicuous coloring of the eggs is of some consequence, and may be the result in some degree of natural selection: but these cases are only a small part of the whole array of bird life, and "protective coloration" certainly fails as yet to account for the coloring of birds' eggs as a whole.

It is much more likely that this phenomenon falls under the theory of "recognition" colors. Many facts go to show that birds recognize their own eggs, and the supposition is reasonable that the tints and markings, if they serve any useful purpose at all, serve that of identification by their owners. This would account for the fact that eggs laid in dark holes are usually white; and it would explain the individual variation within the limits of specific or tribal likeness which universally characterizes the eggs of birds.

**Utilization of Birds' Eggs.** Eggs being intended not only for the production of new beings, but for their nutrition during the embryonic period, mainly consist of a store of highly nutritious material, which is as good food for other animals as for the young birds. Hence all eggs may be called edible, though some are so impregnated with a fishy or musky flavor or odor as to be unpalatable to civilized mankind. The vast use made of the eggs of do-

mestic fowls as food and in the arts is elucidated in another article (see EGG AS A FOOD), but attention may be called here to the fact that in many parts of the world the gathering of the eggs of birds, mainly sea birds, which nest in vast communities, is a regular industry furnishing an important part of the food of the local population. This is especially true of high northern regions. In some of the islands of the Pacific eggs of gregarious sea fowl are gathered by thousands, for the purpose of making from them commercial albumen; but this industry is diminishing by reason of the steady depletion of the numbers of the sea fowl thus disturbed and robbed. The making of collections of eggshells for scientific museums, and still more for the satisfaction of private curiosity and ambition, has long been an industry in which much money is annually expended, rare eggs often commanding very high prices, the few eggs remaining of the extinct great auk (q.v.) being worth at present more than \$2000 each. Lastly it is to be mentioned that in the season when birds are breeding, their eggs and fledglings form an important part of the food of many other animals.

**Mammalian Eggs.** The eggs of all the mammals except the monotremes (q.v.) are minute globules (that of human beings being only about  $\frac{1}{16}$  of an inch in diameter) which pass through all stages of development within the body of the mother. (See EMBRYOLOGY.) The two groups of monotremes, the duckbills and echidnas (qq.v.), however, are ovoviviparous, that is, they produce eggs which are voided from the mother and developed outside her body. These eggs are very much larger than those of other mammals, because they must carry a comparatively large amount of yolk food. Those of the duckbill, two in number annually, are globular, about three-fourths of an inch in diameter, and have a tough yellow calcareous shell; they are deposited in a soft nest in the animal's burrow and hatch there. The echidna produces one egg a year, one-half to three-quarters of an inch in diameter, and covered with a leathery envelope (keratin), which is placed as soon as voided in a mammary pouch and there completes its development.

**Eggs of Reptiles and Amphibians.** Most reptiles are oviparous, laying eggs, either globular or oblong in shape, closely resembling birds' eggs in composition of yolk, albumen, and coverings, except that the shell is not calcareous, but of a tough, yellowish-white, parchment-like (coriaceous) material. "These are usually deposited in holes and left to hatch by the heat of the sun. In the case of the crocodiles they are deposited in a rough nest and guarded by the mother. In all cases development has only progressed to a very early stage when the deposition of the eggs takes place, and it is only after a more or less prolonged period of incubation that the young, fully formed in every respect, emerge from the shell and shift for themselves." These eggs are most numerous in the case of the turtles, numbering from 25 to 250, and are buried in the sand of sea beaches and river banks. Those of the fresh-water species are mostly nauseous, but the eggs of sea turtles are excellent food, will keep fresh a long time, and are extensively gathered, the people of many tropical countries subsisting largely upon them in their season. They are also much fed upon by wild animals. Many lizards and serpents do not lay eggs, but are viviparous; but the pythons not

only lay them but incubate them within the circle of their coiled bodies.

**The Eggs of the Amphibians.** These differ from eggs of reptiles in being small, numerous, having comparatively little yolk, and are usually laid in the water inclosed in masses or cords. Sometimes they, upon the bottom, are attached to submerged plants, or are laid under logs or stones; and in a few cases they are carried about by one or the other parent until they hatch, or the mother coils about them in an underground cell. They are devoured by some aquatic animals. In some forms the eggs hatch before extrusion, thus resulting in viviparity. See MIDWIFE FROG.

**Eggs of Fishes.** The fishes may be broadly divided into "cartilaginous" and "bony," which differ essentially in respect to their eggs. The cartilaginous fishes—sharks, rays, etc. (qq.v.)—which are not viviparous, produce in each case only a few eggs, which are proportionately nearly as large as those of birds or reptiles, and which, like those, are inclosed in protective envelopes and contain much yolk and semiliquid albumen. Some species are viviparous. In those which extrude their ova in a more or less advanced stage of development each egg is covered by a dark-brown chitinous case, which most commonly is flat and four-cornered, with twisted filamentous appendages at the corners, by means of which it becomes attached to seaweeds and the like. These are the "sea purses" of fishermen.

The *bony* fishes mostly emit minute eggs, usually called "spawn," in vast quantities, a number of sea fish producing two or three hundred thousand. The extremes are the sturgeon, which may produce 7,000,000, and the turbot, which may actually deposit twice that number. These are cast into the water and contribute a large part of the food supply of aquatic creatures, nineteen-twentieths, probably, being quickly devoured. Some float at or near the surface; others sink to the bottom. Some fresh-water fishes, however, deposit their eggs in prepared nests, where they are guarded and attended until they hatch. (See NIDIFICATION.) This reduces the proportion of loss so greatly that comparatively few need be produced, and they are far larger, relatively, than in the other case. The eggs of such fishes as the shad, under the name of "roe," and of the sturgeon (caviar), enter largely into the list of human comestibles.

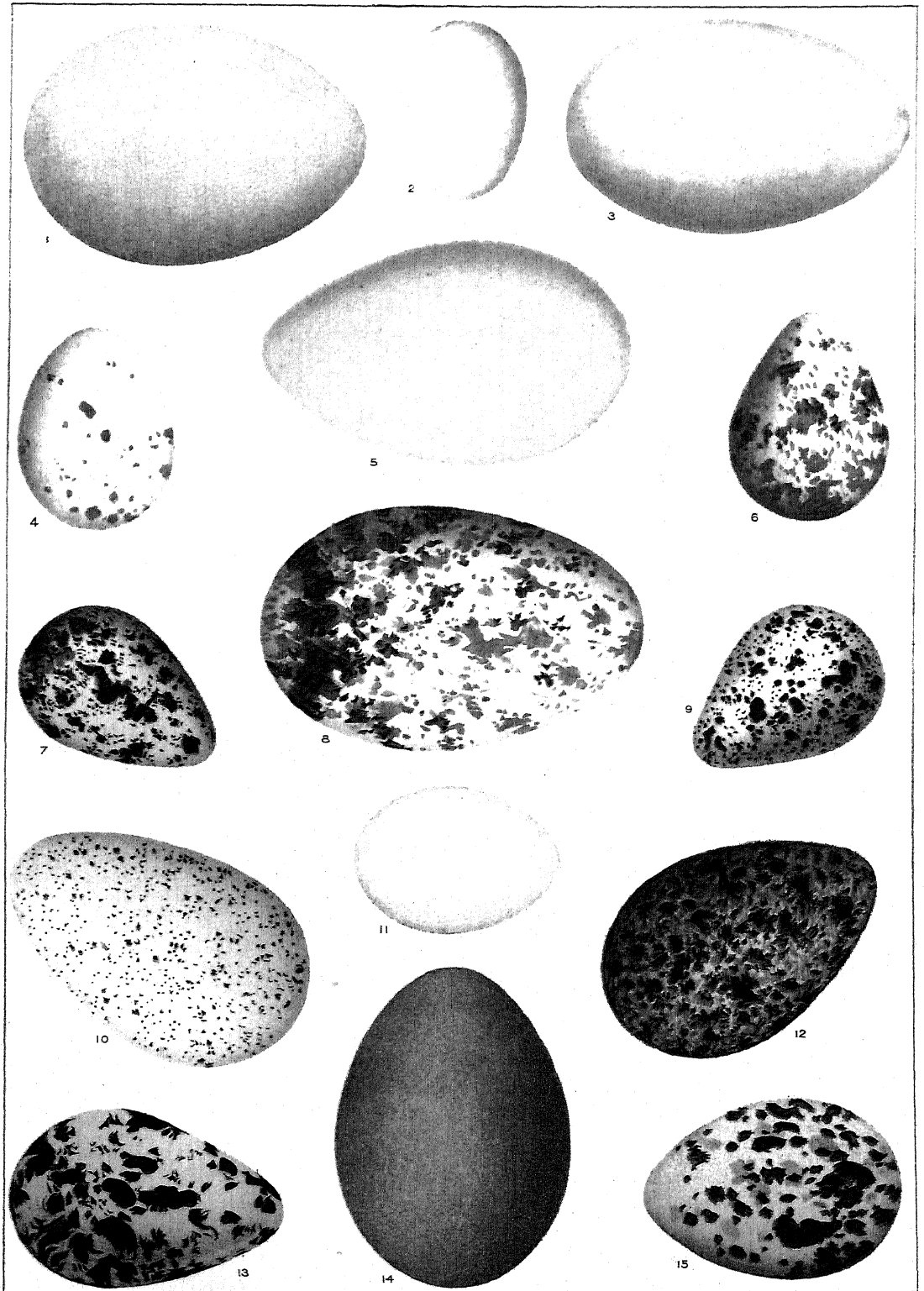
**Eggs of Insects.** Eggs and their deposition among the insects present a great variety of interesting phenomena, of which only a sketch may be given here. In many cases in this class the eggs are so carefully placed as to insure the survival of almost every one, and in proportion as the precautions are complete the number periodically laid is diminished; in fact, in nearly all cases, except in the Hymenoptera, each egg, or else a group of eggs, is within a strong shell or capsule.

Bees, wasps, and ants lay relatively large, elliptical, shell-less eggs, usually each by itself, in the cells of their combs or burrows, placing with them food for the expected larvæ (honey, beebread, palsied spiders, etc.). Other insects

#### TYPES OF EGGS OF WATER AND GAME BIRDS.

1. Pintail duck.
2. Petrel, stormy.
3. Darter.
4. Rail, Virginian.
5. Night heron.
6. Partridge, Gambel's.
7. Phalarope, Wilson's.
8. Ibis, white.
9. Sandpiper, spotted.
10. Coot.
11. Dove, Zenaida.
12. Ptarmigan, willow.
13. Kildeer (plover).
14. Bittern, American.
15. Tern, Arctic.

# EGGS OF AMERICAN WATER AND GAME BIRDS





place them within or upon the bodies of other insects, as is the habit of the parasite ichneumons and chalcidids; or insert them into plant tissues and wood, as do the gallflies, sawflies, etc. Many flies produce living larvæ and others retain their eggs until nearly mature. The bottle-shaped eggs of mosquitoes stick together in a sort of cake or raft that floats on the surface of water; those of the midges are imbedded in jelly, which swells in the water and sticks to a support; the buffalo gnats glue theirs in large patches of submerged rocks. The snipe flies, gadflies, and some others put their eggs on dried branches overhanging the water, sometimes in large pear-shaped masses to which several females contribute, and many others force theirs into the ground or into decaying wood or dung, carrion meat, or wounds, as is the case with house flies, flesh flies, syrphus flies, etc.; while the bots attach theirs to animal hairs, where they may be licked off and develop in the stomach of their host. It is clearly impossible to carry this particular description through the list. One of the longest as well as most entertaining chapters in the admirable *Introduction to Entomology*, by Kirby and Spence, is filled with such details. An excellent summary has been made by Carpenter as follows:

"The outer form of insects' eggs is exceedingly variable. Very many—as those of beetles, grasshoppers, and flies—are elongate, like the cockroach's. The eggs of some moths are globular, while those of butterflies, and especially those of bugs, assume graceful, flasklike shapes and elegantly sculptured surfaces. Other insects—the golden-eye flies, for example—produce stalked eggs, which are raised well above the plant stem on which they are laid, and so protected from mites and other enemies. Insect eggs contain a quantity of food yolk, and are therefore of comparatively large size. The globular egg of the hawk moth, for instance, measures  $\frac{1}{16}$  inch in diameter, while the similarly shaped egg of a cat measures only  $\frac{1}{16}$  inch. The cockroach's eggs are protected by a purse-shaped capsule. Sixteen eggs are contained in this case, eight on a side. . . . Many insects protect their eggs by a gummy secretion; some female moths shed hairs from their bodies to afford the eggs a covering. Those of the water insects are often contained in a long gelatinous tube, and some water beetles construct around their eggs a silken cocoon. Locusts, grasshoppers, and many other insects bury their eggs in the ground for safety; other insects, chafers and crane flies, for example, lay their eggs in the ground that the young may be near the roots of plants on which they will feed. Almost universally the food of the young determines the place of egg laying."

It is an interesting fact that in elliptical eggs of insects the forms of the larvæ or adult, i.e., their dorsal, ventral, and lateral surfaces, are foreshadowed in the shape of the egg. See ANT; BEE; WASP.

**Eggs of Crustacea.** Some crustaceans produce masses of agglutinated eggs, which the female carries about with her, attached to her abdominal appendages, until they hatch. Others lay comparatively few eggs, which are carried about by the female in one or two special sacs; while many simply set their numerous small eggs free in the water.

**Eggs of the Lower Invertebrates.** The eggs of the squids and other cephalopod mollusks are enveloped in a tough viscid membrane, and stick

together in masses, called "sea grapes," which adhere to some fixed object. They contain much food yolk, and the young are well advanced before leaving the shell. Among the ordinary univalved and bivalved mollusks a greater variety in respect to eggs is to be met with than might be expected. The bivalves (*Pelecypoda*) pour out immense quantities of minute eggs and spermatozoa into the water, to meet if they can. A large proportion of this will be wasted, but a still larger proportion (with the floating eggs of other low marine creatures) serves a very useful purpose in supplying food to the hosts of fixed creatures (polyps, sea anemones, other mollusks, etc.), which can obtain food only as it is brought to them by currents of water, and must trust largely to floating eggs and young. Only a very small percentage is fertilized, and a still smaller part ever matures. An exception is afforded by the fresh-water mussels, which keep their eggs within their shells, inclosed within the gills and mantle, and so protect them. Among gastropods the eggs are comparatively few and well cared for. "In almost all the Gastropoda," say Parker and Haswell, "fertilization is internal, and the eggs are laid in great masses imbedded in jelly—each egg having its own hyaline envelope. Very often the mass of spawn, consisting of the jelly-like substance, with the eggs imbedded in it, attains a relatively considerable size. In form it varies greatly; very often it is in the shape of long strings, which are cylindrical or bandlike; sometimes several such strings are twisted together into a cord. Sometimes the spawn is fixed to seaweed or other objects; sometimes it is unattached and may float about freely. In the Streptoneura, instead of a jelly-like mass, the eggs are inclosed in a firm parchment-like capsule, in which is contained, in addition to the eggs, a quantity of an albuminous fluid, serving to nourish the developing embryos. . . . Very commonly large numbers of these capsules are aggregated together, and usually they are attached to a rock or a seaweed or similar object. . . . In the land Pulmonata (snails) each ovum is sometimes imbedded in gelatinous matter inclosed in a firmer envelope, and a number of them are arranged in a string; sometimes a larger number are imbedded in a rounded gelatinous mass. Usually, as in *Helix* and other genera, the outer layers of the albumen-like substance inclosing the eggs become toughened and impregnated with salts of lime, so as to assume the character of a calcareous shell."

**The Annelids** (Annulata) have comparatively large ova, and each has a double gelatinous envelope and contains food yolk; some cast them abroad; by many they are inclosed in packets or cocoons (as is the case in the earthworm), or stick together or to the parent or to some outside object. The egg of the flatworms has a protective chitinous integument, contains food yolk, and sometimes (as among mollusks, insects, etc.) has an operculum facilitating the escape of the matured embryo; also external cement for attachment to other eggs or to some fixed object. The same is true of nematodes, which oviposit vast numbers of eggs—15,000 a day, it is stated. The Trochelmintes (rotifers) lay eggs of three kinds, those produced in the autumn having thick shells to enable them to survive the winter and develop in the spring. Polyzoans and brachiopods produce very few eggs at a time, and these are developed into larvæ in "brood pouches" within

the body. The eggs of echinoderms are minute globules, consisting of germ cell, food yolk, and a glassy exterior layer. They are generally set free in the water, where they are fertilized and developed. Sometimes they stick to the surface upon which they are laid and develop there. The eggs of coelenterates and sponges are hardly worthy of the name, being merely microscopic germ cells, set free in vast quantities as one of several means of reproduction.

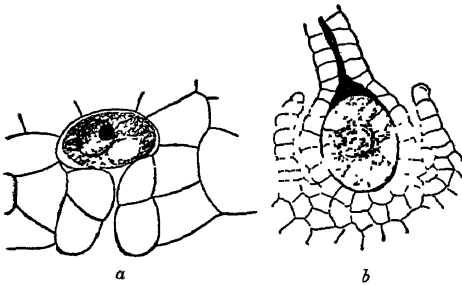
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**EGG.** In plants, the more technical term for the egg is "oosphere." Among the lowest plants in which sexuality is developed, such as the lower algæ and fungi, the two sex cells (gametes) do not differ in appearance, a condition which is called "isogamy." Most plants, however, are not isogamous, their pairing gametes being very dissimilar. The male gamete, called the sperm, is small and usually motile by means of cilia; while the female gamete, called the egg, is

ture called the "archegonium," in whose venter (the bulbous part) the egg . . . while among spermatophytes (seed . . . is no female organ, the egg appearing as a free cell in the embryo sac which is embedded in the ovule. In most cases a solitary egg is formed by a . . . in which it passively remains till . . . by the spore, but there are some interesting exceptions. For example, in the common rockweed (*Fucus*), a brown alga of the sea-shore, some of the species have oögonia which produce eight eggs that are discharged into the water for fertilization. Under ordinary circumstances, an egg must unite with a sperm, that is, it must be fertilized before it can accomplish anything. The new cell thus formed by the fusion of two cells is known as the "oöspore" or "fertilized egg." Occasionally, however, an unfertilized egg may produce a new plant, the phenomenon being known as "parthenogenesis." Parthenogenesis is rather common among the lower plants, and it is not entirely unknown even among seed plants, although its occurrence there has been reported in relatively few forms. See EMBRYO; CELL; CYTOLOGY; SPERM; PARTHENOGENESIS; FERTILIZATION; OÖGONIUM; OÖSPORE.

**EGG.** As a food, perhaps no article of animal origin is more common in all countries or served in a greater variety of ways. Hens' eggs are most popular, although the eggs of ducks, geese, and guinea fowls are used to some extent. More rarely turkeys' eggs are eaten, but they are generally of greater value for hatching. The eggs of the . . . (q.v.), called "plover eggs," are prized in . . . and Germany, while the eggs of sea birds have long been gathered for food. Other eggs besides those of birds are sometimes eaten. Turtle eggs are highly prized in most countries where they are abundant. The eggs of the terrapin are usually served with the flesh. Fish eggs, especially those of the sturgeon, under the name of caviar (q.v.), are eaten in large quantities, preserved with salt. Shad roe is also a familiar example of the use of fish eggs as food. Mention may also be made of the use by some races of the eggs of alligators, lizards, serpents, and various insects.

**Cooking of Eggs.** The methods of serving alone, or in combination with other food materials, are very numerous. Cooked in various ways they are a favorite animal food, taking the place of meat to a certain extent, while raw eggs, usually seasoned in some way, are by no means infrequently eaten. Boiled eggs are often used for garnishing or ornamenting different foods. Eggs are combined with other materials in various ways in many made dishes. They are used in making cakes and such foods to improve the flavor, color, and texture, while in custards, creams, etc., they thicken the material and give it the desired consistency. The white of the egg is employed in making icings and confectionery. Well-beaten egg white incloses air in small bubbles, which in mixing become distributed throughout the mass of dough of cakes and similar foods. The heat of cooking expands the bubbles, which become firm; the porous structure is retained, thus improving both the texture and flavor of the product. The power of eggs to inclose and retain air, when beaten, varies, being greatest in the fresh egg and much less in packed or old eggs. There are several simple ways of cooking eggs which are very commonly followed. Thus, the egg in the shell is cooked by immer-



EGG:  
a, of fern; b, of liverwort.

relatively large and passive. Plants with such dissimilar gametes are said to be "heterogamous." Both sperms and eggs are single, naked cells, but the former are characterized by their activity, the latter by their food supply. As in all living cells, the egg consists of a nucleus invested by more or less cytoplasm, in this case the cytoplasm being conspicuous in amount and containing an abundance of reserve food. Usually a special organ is set apart to develop within itself a single egg. Among algæ and fungi this female organ is generally a single spherical cell, and is called the "oögonium"; among the bryophytes (mosses and their allies), pteridophytes (ferns and their allies), and gymnosperms (conifers and their allies), the female organ is a many-celled, flask-shaped struc-



sion in hot or boiling water, or is less commonly roasted; or, after removal from the shell, the egg is cooked in hot water or in hot fat. In the latter case it may or may not be beaten or stirred. Combined with other materials to form variously made dishes, eggs are boiled, baked, steamed, or fried, as the case may be. The total number of methods of serving and preparing eggs is very large, but in nearly every case it will be found that the method of preparation is only a more or less elaborate modification of one of the simple methods of cooking. When cooked in different ways there are marked changes in the appearance and structure of eggs. If the egg white is gently warmed no change is noticed until the temperature reaches 134° F., when coagulation begins. White fibres appear, which become more numerous, until at about 160° F. the whole mass is coagulated, the white almost opaque, yet tender and jelly-like. If the temperature is raised and continued to 212° F. (the temperature of boiling water), the coagulated albumen becomes much harder, and eventually more or less tough and hornlike; it also undergoes shrinkage. When the whole egg is cooked in boiling water the temperature of the interior does not immediately reach 212° F., several minutes being probably required. The yolk of egg coagulates firmly at a lower temperature than the white. The fact that egg white becomes hard and contracts when heated for some time, at the temperature of boiling water, explains the curdling of custards, shrinkage and toughening of omelets, soufflés, meringues, sponge cake, and similar mixtures. The firm coagulation of albumen at 212° F. explains the use of egg white for clarifying coffee, soup, or other liquids. The albumen, which is mixed

shells. Large quantities of egg white are used for other purposes than for food, such as for manufacturing photographic papers; the yolks also are utilized in the arts.

**Characteristics and Composition.** The eggs of different kinds of domestic poultry vary in size, as well as appearance, and there is also a considerable range in the size of eggs of different breeds. On an average, a hen's egg is 2.27 inches in length and 1.72 inches in diameter, or width, at the broadest point, and weighs about 2 ounces, or eight *grams* to the pound (1½ pounds per dozen). Generally speaking, the eggs of pullets are smaller than those of old hens, those of ducks somewhat larger than hens' eggs, while those of turkeys and geese are considerably larger. Guinea eggs, on an average, measure 1½ by 1½ inches, are rather pointed at one end, and weigh about 1.4 ounces each, or 17 ounces to the dozen. Goose eggs weigh about 5.5 to 6.7 ounces each, or about 5 pounds to the dozen, i.e., more than three times as much as hens' eggs. The eggs of wild birds are said to be smaller than those of the same species when domesticated. Wild ducks' eggs are, on an average, 1.97 to 2.17 inches in diameter; domestic ducks' eggs, 2.36 to 2.56 inches. The shells of hens' eggs constitute about 11 per cent, the yolk 32 per cent, and the white 57 per cent of the total weight of the egg. White-shelled eggs have a somewhat heavier shell than brown-shelled eggs. The shell of a duck's egg constitutes about 14 per cent of the total weight and that of a plover's egg 10 per cent. The following table shows the composition of the eggs of poultry and the plover, and, for comparison, that of evaporated hens' eggs, egg substitute, and pudding powder:

TABLE SHOWING AVERAGE COMPOSITION OF EGGS AND EGG PRODUCTS

	Water	Protein	Fat	Carbohy- drates	Ash	Fuel value per pound
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Calories</i>
<b>Hen:</b>				See following paragraph.		
Whole egg, edible portion.....	73.7	13.4	10.5		1.0	720
White.....	86.2	12.3	0.2		0.6	250
Yolk.....	49.5	15.7	33.3		1.1	1705
<b>Duck:</b>						
Whole egg, edible portion.....	70.5	13.3	14.5		1.0	860
White.....	87.0	11.1	0.03		0.8	210
Yolk.....	45.8	16.8	36.2		1.2	1840
<b>Goose:</b>						
Whole egg, edible portion.....	69.5	13.8	14.4		1.0	865
White.....	86.3	11.6	0.02		0.8	215
Yolk.....	44.1	17.3	36.2		1.3	1850
<b>Turkey:</b>						
Whole egg, edible portion.....	73.7	13.4	11.2		0.9	720
White.....	86.7	11.5	0.03		0.8	215
Yolk.....	48.3	17.4	32.9		1.2	1710
<b>Guinea Fowl:</b>						
Whole egg, edible portion.....	72.8	13.5	12.0		0.9	755
White.....	86.6	4.6	0.03		0.8	218
Yolk.....	49.7	16.7	31.8		1.2	1655
<b>Plover:</b>						
Whole egg, edible portion.....	74.4	10.7	11.7		1.0	695
Evaporated hens' eggs.....	6.4	46.9	36.0	7.1	3.6	2525
Egg substitute.....	11.4	73.9	0.3	5.3	9.1	1480
Pudding (custard) powder.....	13.0	2.1	3.4	80.9	0.6	1690

with the liquid before boiling, coagulates and incloses the floating particles, leaving the liquor clear. When eggs are removed from the shell, a little of the white, unless scraped off, usually clings to the inner surface. Such eggshells are often used for clarifying purposes, instead of the whole egg. The clarifying properties are, of course, due to the egg white, and not to the

Eggs consist chiefly of two nutrients—protein and fat—in addition to water and mineral matter or ash. Carbohydrates are present in such small amounts that they are usually neglected in the analysis. The results of numerous analyses show that there is practically no difference in composition between hens' eggs with dark shells and those with white shells, although

there is a popular belief that the former are "richer." In general, it may be said that eggs are nutritious food. They are less concentrated, i.e., contain more water, than cheese, but are more concentrated than milk or oysters. In water content they do not differ greatly from the average value for lean meat. The kinds and amounts of nutrients in eggs indicate that they may be properly used in the diet in the same way as most other animal foods, and this belief is confirmed by experience.

**Food Value.** Eggs which are perfectly fresh have the finest flavor. After eggs have been kept for a time the flavor deteriorates, even if there be no indication of spoiling. Such differences are especially important when eggs are used for table purposes. Stale eggs are regarded as not palatable, and the flavor of spoiled eggs is such that because of it, if for no other reason, they are totally unfit for food. The flavor of even perfectly fresh eggs is not always satisfactory, since it is influenced more or less by the character of the food eaten by the laying hens, onions and some other highly flavored feeds imparting an unpleasant flavor to the eggs. The flavor is also impaired when the air in which the eggs are stored is tainted by odors such as those of decaying vegetables, rancid fats, and gases of various kinds.

Raw eggs or eggs only slightly cooked are commonly said to be very indigestible, the idea being obviously that they digest readily without giving rise to pain or other physical discomfort. This is in accord with the results of numerous experiments, which show that the length of time that eggs are cooked affects somewhat the time required for digestion, and that some 95 per cent of the total dry matter, 97 per cent of the protein, and 95 per cent of the fat of eggs is digestible. It seems fair to conclude that the length of time of cooking has less effect upon the percentage amount that may be digested than upon the time required for digestion. In a healthy man, the latter consideration is probably not a matter of much importance; in the diet of sick persons and invalids it may be more important. In the average of several hundred dietary studies in American families eggs furnished 2 per cent of the total food, 4 per cent of the total protein, and 3 per cent of the total fat used per man per day. In this respect, eggs compare favorably with the more common animal foods.

**Marketing and Testing.** In earlier times eggs, if sold at all, were marketed near the place where they were produced. Many are still sold in local markets; but with improved methods of transportation the market has been extended, and eggs may be shipped to far-distant points. For shipping long distances, there are special egg cases. Eggs which are to be shipped, whether with or without a special attempt at preservation, should be perfectly fresh, and should never be packed in any material which has a disagreeable odor. Microorganisms enter the egg through the minute pores in the shell, and set up fermentation, which ruins the egg. In other words, it becomes rotten. The unpleasant odor of rotten eggs is due to the formation of sulphureted hydrogen. The normal eggshell has a natural surface coating of mucilaginous matter, which hinders the entrance of these harmful organisms for a considerable time. If this coating be removed or softened by washing or otherwise, the keeping quality

of the egg is much diminished. If the process of hatching has begun, the flavor of the egg is also injured. There are many ways of testing the freshness of eggs which are more or less satisfactory. "Candling" is one of the methods most commonly followed. The eggs, when held against a light in a suitable device, appear unclouded and almost translucent when fresh, and dark colored if they are addled. A dark spot may be observed if incubation has begun, which increases in size according to the stage to which incubation has advanced. The age of eggs may be approximately judged by taking advantage of the fact that, as they grow old, their density decreases through evaporation of moisture. According to Siebel, a new-laid egg placed in a vessel of brine made in the proportion of two ounces of salt to one pint of water will at once sink to the bottom. An egg one day old will sink below the surface, but not to the bottom, while one three days old will swim just immersed in the liquid. If more than three days old, the egg will float on the surface, the amount of shell exposed increasing with age; and if two weeks old, only a little of the shell will dip in the liquid. The humidity of the atmosphere in which the eggs were kept would doubtless influence the results.

**Methods of Preservation.** Fresh eggs are preserved in a number of ways, which may, for convenience, be grouped under two general classes, which are often combined: (1) Use of low temperature, i.e., cold storage; and (2) excluding the air by coating, covering, or immersing the eggs, some material or solution being used which may or may not be a germicide. The first method owes its value to the fact that microorganisms, like larger forms of plant life, will not grow below a certain temperature, the necessary degree of cold varying with the species. It is stated by Siebel that, in practice in the United States, 32° to 33° F. is regarded as the best temperature for storing eggs, although some American packers prefer 31° to 34°. English writers recommend a temperature of 40° to 45° as being equally satisfactory. Without doubt the amount of moisture in the air in the cold-storage chamber has an important bearing on this point. Eggs are generally placed in cold storage in April and the early part of May; if later than this time they do not keep well. They are seldom kept in storage longer than a year. Eggs which have been stored at a temperature of 30° must be used soon after removal from storage, while those stored at 35° to 40° will keep for a considerable time after removal from storage, and are said to have the flavor of fresh eggs. Stored eggs should be turned at least twice a week, to prevent the yolk from adhering to the shell. Eggs are sometimes removed from the shells and stored in bulk, usually on a commercial scale in cans containing about fifty pounds each. The temperature recommended is about 30° F., a little below freezing, and it is said they will keep any desired length of time. They must be used soon after they have been removed from storage and have been thawed. The substances suggested and the methods tried for excluding air conveying microorganisms into the egg, and for killing those already present, are very numerous. An old domestic method is to pack the eggs in oats or bran. Another, which has always had many advocates, consists in covering the eggs with limewater, which may or

may not contain salt. The results obtained by such methods are not by any means uniform. Sometimes the eggs remain fresh and of good flavor, and at other times they spoil. A method of preserving eggs, which has recently been often used with much success, consists in packing them in carefully cleaned vessels of suitable shape, and covering them with a 10 per cent solution of water glass (sodium silicate or potassium silicate). The shells of eggs preserved in water glass are apt to crack in boiling, but, it is stated, this may be prevented by puncturing the blunt end of the egg with a pin before putting it into the water. In the East Indian Archipelago salted ducks' eggs are an article of diet, the new-laid eggs having been packed for two or three weeks in a mixture of clay, brick dust, and salt. They are eaten hard-boiled. In that region and in India, turtle eggs are also preserved in salt. These products, while unusual, do not necessarily suggest an unpleasant article of diet. The same can hardly be said of a Chinese product which has often been described. Ducks' eggs are buried in the ground for 10 or 12 months and undergo a peculiar fermentation. The hydrogen sulphide formed breaks the shell and escapes, while the egg becomes hard in texture. The final product, it is said, does not possess a disagreeable odor or taste.

**Diseases Caused by Egg Eating.** Some persons are habitually made ill by eating eggs, just as there are those who cannot eat strawberries or other food without distress. Such cases are due to some personal idiosyncrasy. Overindulgence in eggs, as is the case with other foods, may induce indigestion or other bad effects. Furthermore, under certain conditions, eggs may be the cause of illness by communicating some bacterial disease or some parasite. It is possible for an egg to become infected with microorganisms before it is laid as well as after. The shell is porous and offers no greater resistance to microorganisms which cause disease than it does to those which cause the egg to spoil. If the infected egg be eaten raw, the microorganisms present may gain entrance to the tissues and cause disease. Judged by the comparatively small number of cases of infection or poisoning due to eggs reported in medical literature, the danger of disease from this source is not very great. However, in view of its possibility, it is best to keep eggs as clean as possible, to reject or thoroughly cook doubtful ones, and thus endeavor to prevent infection.

**Commercial Importance.** The egg industry is of considerable commercial importance. The total number of eggs produced on farms in the United States in 1909 was estimated by the census bureau at 1,591,311,000 dozen, or 17 dozen per capita of the population; and their value at \$306,689,000.

**Egg Powders, Desiccated Eggs, and Egg Substitutes.** Several methods of evaporating or desiccating eggs have been proposed, and products which claim to be prepared in these ways are now on the market. The egg is dried in or out of a vacuum, usually by a gentle heat or by currents of air. Before being placed on the market the material is usually ground. Sometimes salt and sugar are used as preservatives. As will be seen by reference to the above table of composition, such products are merely eggs from which the bulk of water has been removed. If the process of manufacture be such

that the resulting product is palatable and keeps well, the value of evaporated eggs for many purposes is evident. This material is used by bakers to some extent, as being cheaper, when fresh eggs are high in price. Since, if all the water be removed in preparing evaporated eggs, one pound of the dried product will furnish material equivalent to about four pounds of fresh eggs, and since desiccated foods have the advantage over the fresh substances of reduced bulk, evaporated eggs are used in provisioning camps and expeditions.

Egg substitutes have been devised which consist of mixtures of animal or vegetable fats, albumen, starch or flour, coloring matter, and some leavening powder in addition to the mineral matters similar to those found in the egg. Such products are designed to resemble eggs in composition. One has been manufactured from skim milk containing the casein and albumen of the milk, mixed with a little flour. It is put up in the form of a paste or powder. Other egg substitutes have been marketed which contain little or no albumen, but which apparently consist quite largely of starch, more or less colored, with some yellow substance. These goods, sometimes called "pudding" or "custard powder," are specially recommended for making custards and puddings similar in appearance to those in which fresh eggs are used. There is no reason to suppose that such products cannot be made so that they will be wholesome and perfectly harmless; but the fact must not be overlooked that in the diet they cannot replace fresh eggs, since they do not contain much nitrogenous matter or fat. This may be an important matter if such an egg substitute be used in the diet of invalids, especially if the composition of the egg substitute is not known, and it be employed with the belief that, like eggs, it contains an abundance of protein.

**EGG, or EIGG.** An island of the Inner Hebrides (q.v.) group, 12 miles off the west coast of Inverness-shire, Scotland, and 8 miles southwest of Sleat Point in Skye (Map: Scotland, B 3). It is about  $6\frac{1}{2}$  miles long and terminates on the southwest in the remarkable Scur of Egg, which rises to 1346 feet. The upper 470 feet of this hill is a mass or vein of pitchstone. Some of the pitchstone forms straight, inclined, or curved columns, which vary in diameter from a few inches to nearly 2 feet. In the south part of the island is a large cave, entered by a narrow opening, through which but one person can creep at a time. Here, in the sixteenth century, a feudal laird of Macleod, to revenge an injury done to some of his clan, smoked to death all of the inhabitants (200 Macdonalds) of the island, who had hidden themselves in the cave. Pop., 250.

**EGG, AUGUSTUS LEOPOLD (1816-63).** An English genre painter. He was born in London and studied under Sass and at the Royal Academy. He painted chiefly genre pictures and, like Leslie and Newton, chose his subjects from literature and history. His pictures show a greater feeling for color than Leslie's, but are without his humor, and in a scene from "Le Diable Boiteux" (1844, National Gallery) he shows an execution superior to Newton's. The influence of the Pre-Raphaelites is traced in "Pepys's Introduction to Nell Gwynne" (1851). Among other noteworthy paintings are: "Peter the Great Sees Catharine for the First Time" (1850); "The Knighting of Esmond" (Tate

Gallery, London); and "Katherine and Perfruchio" (1860). In 1860 Egg became a Royal Academician.

**EGGA.** A town of Nupé, in British Nigeria, West Africa, situated on the right bank of the Niger. Its commerce is very important and it has a considerable transient population. The inhabitants, who number about 15,000, are chiefly engaged in trade.

**EGG-AND-DART.** A motive of ornament commonly decorating a convex molding or ovolo (q.v.), and consisting of an egg-shaped solid (ove) set in a frame, or "shell," with a tongue, dart, or arrow between each pair of shells. It is allied to the bead-and-reel and water-leaf ornaments, was first used in Greek art as a painted motive on vase lips and architectural moldings, and was later carved on moldings of the Ionic order. It is common in Roman, Renaissance, and modern art, and occurs sometimes in mediæval art. See **MOLDING**.

**EGG APPARATUS.** A group of three cells in the embryo sac of Angiosperms. One of the cells is the egg, and the two others are synergids, whose name suggests that they are of service in connection with the fertilization of the egg.

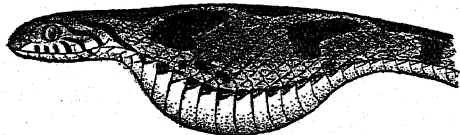
**EGGAR MOTH.** See **EGGER MOTH**.

**EGG BIRD.** Any wild bird whose eggs are regularly sought as food by mankind; especially, a gull or tern and, in particular, the sooty tern. See **TERN**.

**EGG COCKLE.** The common edible cockle of Europe. See **COCKLE**.

**EGG DANCE.** A very old English dance, which was probably derived from the Saxons. Eggs were placed at certain intervals on the floor, and the dancer took his position and was blindfolded. The music used was the hornpipe, and to it the performer danced back and forth between the eggs without touching them. The positions of the eggs and the figures danced seem always to have been the same. A similar feat was very popular in Holland in the seventeenth century, and the Valencians in Spain have much the same sort of a dance at the present time.

**EGG-EATING SNAKE.** A remarkable little colubrine serpent (*Dasypeltis scabra*) of South Africa, whose dentition and throat are specially adapted to the consumption of birds' eggs, upon which this snake mainly subsists. It is a



AN EGG-EATING SNAKE.

Appearance of the snake (*Dasypeltis scabra*), with an unbroken egg in its gullet, showing the extensibility of jaws and throat.

slender little creature, prettily variegated, and about 2 feet in length. Its mouth has no teeth, or at least a few very rudimentary ones, but has "about 30 of what may be termed throat teeth; these being the lower spines of the vertebræ, which project into the œsophagus and are tipped with enamel." It lives in trees and feeds on the eggs of small birds, but, when pressed by hunger, will descend and rob hens' nests; and the elasticity of its mouth and throat is so great that it can take into them pigeons' eggs

with ease and even large fowls' eggs. When the egg is fairly within the throat, the throat teeth cut through the shell, allowing all its fluid contents to be swallowed without the loss of a drop, after which the crushed shell and membranes are ejected. An illustrated article upon examples living in the Zoölogical Gardens of London may be found in the *Field* (London, 1892), while a very exhaustive and illustrated treatise may be found in Fitzsimons, *Snakes of South Africa* (Cape Town, 1912).

**EG'GELING, JULIUS** (1842- ). An English Sanskrit scholar. He was born at Heeklingen, Germany, and was educated at Breslau and Berlin (1862-66). Within a year after his graduation he went to England, where in 1869 he was appointed secretary and librarian of the Royal Asiatic Society. In 1872 he became professor of Sanskrit at University College and three years afterward was called in the same capacity to Edinburgh. His publications include: *The Catapatha-Brāhmaṇa, Translated according to the Text of the Mādhyandina School* (vols. i-v in "Sacred Books of the East," 1882-85); *Catalogue of Buddhist Sanskrit Manuscripts in the Possession of the Royal Asiatic Society*, with Cowell (1875); the article "Sanskrit Language and Literature," in the *Encyclopædia Britannica* (1887); *Catalogue of Sanskrit Manuscripts in the Library of the India Office* (7 parts, 1887-1904); and editions of *Vardhamāna's Gaṇaratnamahodadhi* (2 parts, 1879-80), the *Kātantra* (6 books, 1874-78), and of the *Koṇva Satapatha Brāhmaṇa* (1902).

**EGGER, á'gär', EMILE** (1813-85). A French classical scholar, born in Paris. After holding various professorships of ancient languages, he was professor of Greek literature at the Faculté des Lettres of the University of Paris from 1855 to 1884. Among his best-known works are: *La poétique d'Aristote* (1850), probably his most interesting work; *Notions élémentaires de grammaire comparée*, the earliest work of its kind in Europe (1852); *Mémoires d'histoire ancienne et de philologie* (1863); and his masterpiece, *L'Hellénisme en France* (1869), dealing with the influence of the Greek upon the French language. He wrote much on Greek papyri and on Greek inscriptions and was a frequent contributor to the *Mémoires de l'Académie des Inscriptions*, the *Journal de l'Instruction Publique*, *Revue des Deux Mondes*, and to the *Journal des Savants*, of which he became editor in 1871. He was a member of the Academy of Inscriptions and an officer of the Legion of Honor. Consult Bailly, *Notice sur Emile Egger* (Paris, 1886), and Sandys, *A History of Classical Scholarship*, vol. iii (Cambridge, 1908).

**EGGER MOTH.** A bombycid moth of either the genus *Lasiocampa* or *Eriogaster*. The name is chiefly in use among British lepidopterists and is often spelled *eggar*.

**EG'GERS, JAKOB, BARON** (1704-73). A Swedish soldier and military author, born at Dorpat, Livonia. In 1722 he entered the service of Sweden and devoted himself to the study of the science of fortification. He subsequently served Poland, Hesse (1735), Saxony, and Sweden (1742) where he was quartermaster-general and adjutant to the King and served in the campaign against Russia in 1742-43. He was again in the Saxon army in 1744 and then in the French. He became a Swedish baron in 1772. His description of the siege of

Bergen-op-Zoom, *Journal du siège de Bergopzoom* (1750), which he witnessed as a volunteer in the French army, is a vivid portrayal of that engagement. In 1751 he published an improvement of Desbois's *Dictionnaire militaire*, which was followed in 1757 by an independent work, entitled *Neues Kriegs-, Ingenieur-, Artillerie-, See- und Ritter-Lexikon*.

**EGGFISH** (so called from the shape when inflated). A globefish, especially *Tetrodon turgidus*. See **GLOBEFISH**.

**EGGLESTON, EDWARD** (1837-1902). An American novelist and historian. He was born at Vevay, Ind., Dec. 10, 1837, the son of a lawyer. Of delicate health in childhood and largely self-educated, he began life as a Methodist circuit rider and was then agent in Minnesota for the Bible Society, doing such pastoral work as his health permitted and engaging in other pursuits as opportunity offered. In 1866 he went to Evanston, Ill., and for a time edited a children's paper. In 1867 he removed to Chicago and edited the *Sunday School Teacher*, gaining national reputation as manager of Sunday-school teachers' institutes and as a speaker at Sunday-school conventions. Meanwhile he contributed with increasing frequency to the *New York Independent*, in 1870 became its literary editor, and soon afterward superintending editor, a post that he resigned to become editor of *Hearth and Home*, which again he gave up for a Brooklyn pastorate (1874-79), finally retiring to a country place on Lake George and devoting himself to literature. He had already made southern Indiana peculiarly his own in fiction by his racy *Hoosier Schoolmaster* (1871), a great success, appearing first in *Hearth and Home*. He followed this up with other novels, some of them quite popular: *The End of the World* (1872; reissued in an illustrated edition, 1908); *Mystery of Metropolisville* (1873); *The Circuit Rider* (1874); *Roxy* (1878). He now began, with the help of his daughter, Mrs. Lillie E. Seelye, the publication of juvenile biographies of American Indians: *Tecumseh* (1878); *Pocahontas and Powhatan* (1879); *Brant and Red Jacket* (1879); *Montezuma* (1880). In 1883 he returned to Indiana fiction in *The Hoosier School Boy*, continuing with *The Graysons* (1888), *The Faith Doctor* (1891), *Duffels* (1893). His biographical studies led him to a wider study of American history, in which he was mainly interested during his last years. Among his works in this field are *A Household History of the United States* (1888) and a series of volumes on the development of American society, *The Beginners of a Nation* (1896), and *The Transit of Civilization* (1900)—which are marked by a very minute knowledge of Colonial life and thought, and with their attractive style are among the best of recent American histories, in spite of a certain want of sympathy with the mental attitude of the epochs described. In 1900 Eggleston was president of the American Historical Association. Consult O. C. Auringer, *Friendship's Crown of Verse* (Clinton, N. Y., 1907).

**EGGLESTON, GEORGE CARY** (1839-1911). An American editor, novelist, and miscellaneous writer, brother of Edward Eggleston. He was born at Vevay, Ind., and was educated at Asbury University, Ind., and Richmond College, Va. He studied law, practiced, and served in the Confederate army throughout the Civil War.

In metropolitan journalism he served as managing editor of *Hearth and Home* (1871-74); editor of *American Homes* (1874-75); literary editor of the *New York Evening Post* (1875-81); literary editor of the *Commercial Advertiser* (1884), later its editor in chief (1886-89), and finally a member of the staff of the *World*. He wrote *A Rebel's Recollections* (1874) and also numerous books for the young. More important are such novels as: *Southern Soldier Stories* (1890); *The Last of the Flatboats* (1900); *A Carolina Cavalier* (1901); *Dorothy South* (1902); *A Daughter of the South* (1905); *Life in the 18th Century* (1905); *Our First Century* (1905). Later works are *History of the Confederate War* (2 vols., New York, 1910), and *Recollections of a Varied Life* (New York, 1910).

**EGGMÜHL**. See **ECKMÜHL**.

**EGGPLANT** (*Solanum melongena*). A plant, native of the tropics, usually less than 2 feet high, with stem partially woody; the fruit somewhat resembles an egg in shape, and varies from the size of a hen's egg to 6 or even 8 inches in diameter, in color generally purple, white, or yellow. The fruit is much used as a vegetable in warm countries, especially in the East Indies. It is successfully grown in the northern portion of the United States when started in a hotbed. The white-fruited varieties are said to be most popular in Europe, but in America the black and purple varieties are most in favor. The early dwarf purple is an especially good variety for the Northern States. The New York purple and black Pekin are excellent shipping varieties. The plant grows well in the South on almost any good soil and gives better results with commercial fertilizers than with fresh barnyard manure. Eggplants should be well thinned out in the seed bed and kept growing vigorously. They tend to make rather slow growth the first few weeks and are easily stunted through neglect during this period.

**Eggplant Diseases**. The diseases to which the eggplant is subject are neither numerous nor very destructive, although at times they become epidemic, scarcely a plant escaping. The anthracnose (q.v.) (*Glomerum melongena*) attacks the fruits, producing small sunken areas which contain minute pink blotches. A mold (*Botrytis fascicularis*) attacks the fruit, causing a rapid softening in spots, accompanied with a gray mold on the surface. A leaf spot due to the fungus *Phyllosticta hortorum* attacks the leaves, causing the tissues to turn brown, dry up, and fall away, leaving ragged holes. The fruit may also be attacked by this fungus, after which soft, sunken patches appear. The disease spreads until the entire fruit is a rotten mass. All these diseases may be checked in their spread by the use of any of the standard fungicides, e.g., Bordeaux mixture. A bacterial disease caused by *Bacillus solanacearum* is sometimes very destructive. For illustration, see Plate of **VEGETABLES, GARDEN**.

**EGG POWDERS**. See **EGG** as a food.

**EGGSHELL CHINA**. A very thin and translucent variety of china, originally made in China, but now produced in European factories.

**EGG TOOTH**. A hard, sharp prominence on the tip of the beak or nose of embryo birds and egg-born reptiles, enabling them to break through the eggshell at hatching time without

injury to the organ. It is described by Newton as composed of calcareous matter, not connected with the underlying bone, deposited in the middle layer of the epidermis of the tip of the upper mandible (of birds). In both birds and reptiles it peels off and is dropped soon after the hatching. An analogous arrangement appears in the great jaws of certain insects, used only for freeing themselves from their cocoons; and Darwin, *Origin of Species* (London, 1882), bases an argument for his theory of natural selection upon the existence of such temporary structures, serving a highly important service only once in an animal's lifetime, pointing out that a small superiority of equipment in this respect might alone save the life of the animal at the critical moment of its attempting to escape from the egg, and that those best endowed would be most likely to survive and perpetuate this useful feature.

**EGHAM**, ĕg'am. A village in the northwest of Surrey, England, on the right bank of the Thames, 21 miles west-southwest of London (Map: London, F 2). In the vicinity are Runnymede (q.v.) and Cooper's Hill, which was rendered famous by Denham and Pope. Pop., 1901, 11,895; 1911, 12,551.

**EGIDY**, ā-gē'dē, CHRISTOPH MORITZ VON (1847-98). A German soldier and writer on ethical topics. He was born at Mainz, entered a Brandenburg regiment as lieutenant in 1865, and a cavalry regiment of the army of Saxony in 1868. He attained the rank of lieutenant colonel in 1889 and in 1890 retired from the service. His pamphlet, *Ernste Gedanken* (1890), was widely circulated, aroused much discussion and comment, and was the basis of the so-called *Egidy Bewegung* (movement), which in a rather ill-defined way sought to effect a nonsectarian and undogmatic Christianity. *Weiteres zu den Ernsten Gedanken* (1890) and *Ausbau der Ernsten Gedanken* (1891) were supplementary, and in 1892 a quarterly, *Einiges Christentum*, appeared at Kiel (from 1899 at Berlin as *Ernstes Denken* with the title *Ernstes Wollen*). (Cf. *Die Dichtersmann und Mülberger. Moritz von Egidy, sein Leben und Wirken* (2 vols., Dresden, 1900).)

**EGILL SKALLAGRIMSSON** (c.900-983). An Icelandic skald. His parents were among those who were forced to emigrate after Harold Fairhair's victory at Hafrsfjord. Egill entered the service of the English King Athelstan in 925 and fought under him for several years. He returned to Norway after Harold's death and revenged himself upon his successor, Erik Blóðöx (Blood ax), by killing his son in 934. Afterward he was taken prisoner by Erik and only regained his liberty by composing a number of stanzas praising that King. This poem, which was called *Höfudhlaun* (The Redemption of the Head), was partly translated into Swedish by Sörensen (1866); and by Åkerblom, 1899. His greatest saga, *Sonatorrek*, was composed on the death of his favorite son. It is full of the bitterest grief and an unquenchable pride. He also composed a saga to celebrate his friend Arinbjörn, the *Arinbjarnardrápa* (975), translated into Swedish by Björlin in 1864, and the *Skjaldardrápa* (970). The famous Icelandic poem called "Egill's Saga," which some critics suppose to be by Snorri Sturluson, is a glowing description of Egill's career and contains the above-mentioned poems. Consult Jónsson's edition of this saga (Copen-

hagen, 1886-88, and 1894, translated by N. M. Petersen (1862), new ed. by Dahlerup and Jónsson (1901), and Halle, 1894).

**EGILSSON**, ā'gil-sōn, SVEINBJÖRN (1791-1852). An Icelandic philologist, born in Iceland. After completing a course of study at the University of Copenhagen he returned to Iceland. For several years he was rector of the Latin school at Reykjavík. He retired in 1851. His best known by his dictionary of Old Norse poetry (*Lexicon Poeticum Antiquæ Lingvæ Septentrionalis*, 1860). He also published a number of articles on Old Norse and an edition of Snorri's *Edda* (1848-52).

**EGINA**. See **ÆGINA**.

**EGINHARD**, ĕg'in-hārd. See **EINHARD**.

**EG-LAMORE**, STR. One of the Knights of the Round Table, and the hero of a popular ballad which tells of his slaying a terrible dragon.

**EG-LANTINE** (Fr. *églantine*, from OF. *aiglant*, *aiglent*, Portug. *aguilen*, sweetbrier, from Lat. *aculeus*, thorn, from *acus*, needle). A name given to two species of rose and sometimes, erroneously, to honeysuckle. The first species, *Rosa rubiginosa*, is a dense shrub, often 6 feet tall, the stems of which bear hooked prickles, dark-green leaves, and, in June, bright-pink, short-stemmed, sweet-scented flowers, followed by orange-red or scarlet fruits. It is a native of Europe, but has become naturalized in many parts of the eastern United States and Canada. Some of its cultivated double forms and some of its hybrids with other species of rose are very attractive. The second species, *Rosa eglanteria*, is a West Asian shrub, with long climbing stems, bearing straight prickles, dark-green leaves, and, in June, yellow flowers, which have to many persons an offensive odor.

**EGLANTINE**, ā'glān-tēn', MADAME. The prioress of Chaucer's *Canterbury Tales*.

**EGLESTON**, THOMAS (1832-1900). An American mineralogist and metallurgist, born in New York City. He graduated from Yale and from the Ecole des Mines in Paris in 1860. In 1861 he was placed in charge of the mineral collections of the Smithsonian Institution. In 1863 he submitted to the trustees of Columbia College a plan for a school of mines in New York City, and from the opening of the school in 1864 to 1897 Egleston was professor of mineralogy and metallurgy. This was the first American institution for practical instruction in mining and metallurgy. In 1866 he directed a geological and agricultural survey of the first 100 miles of the Union Pacific Railroad. He also served as a United States commissioner to examine the Atlantic coast fortifications in 1868 and was a juror of the International Exposition at Vienna in 1873. The French government honored him with the decoration of the Legion of Honor in 1890. He was one of the founders of the American Institute of Mining Engineers (president in 1886) and also of the American Metrological Society and was vice president of the New York Academy of Sciences (1869-81). His publications include: *Tables for the Determination of Minerals* (1867); *Metallurgical Tables on Fuels, Iron, and Steel* (1869); *Lectures on Mineralogy* (1871); *The Metallurgy of Gold, Silver, and Mercury in the United States* (1887); *A Catalogue of Minerals and their Synonyms* (1889).

**EGLI**, ā'glē, JOHANN JAKOB (1825-96). A Swiss geographer. He was born at Uhwiesen-



Laufen in the Canton of Zurich and after teaching at various schools was in 1883 appointed professor of geography at the University of Zurich. He may be said to have been the founder of the science of geographical nomenclature. His principal works devoted to this subject are: *Nomina Geographica, Versuch einer allgemeinen geographischen Onomatologie* (2d ed., 1893); *Geschichte der geographischen Namenkunde* (1886). Among his other works are: *Geographie für höhere Volksschulen* (1857; 8th ed., 1887); *Neue Schweizerkunde* (8th ed., 1890); *Neue Erdkunde* (8th ed., 1894); *Neue Handels-geographie* (5th ed., 1892); *Der Völkergeist in den geographischen Namen* (1894).

**EGLINTON AND WINTON, ARCHIBALD WILLIAM MONTGOMERIE, EARL OF** (1812-61). An English politician. He was born in Palermo, Sicily, was educated at Eton, and succeeded his grandfather as Earl of Eglinton in 1819. He was an enthusiastic sportsman and won the Derby and the St. Leger with Flying Dutchman in 1849. In 1839 he carried out the celebrated tournament at Eglinton Castle, Ayrshire, described by Disraeli in *Endymion*. He did much for the game of bowls and in 1857 gave a gold bowl and the Eglinton cup as an annual trophy. He was Lord Lieutenant of Ireland in 1852 and again in 1858-59. He was very popular in Scotland and in 1852 was elected lord rector of Glasgow and of Marischal College, Aberdeen. He became Earl of Winton in the peerage of the United Kingdom in 1859. There is a statue of him in Ayr.

**EGLON.** 1. A king in Moab, who, according to Judg. iii. 12-30, oppressed Israel for 18 years and was assassinated by the Benjaminite Ehud (q.v.). 2. An Amorite city mentioned in Josh. x. 36; xii. 12, xv. 39. Its King, Debir, is represented as joining the league against Joshua that was led by Adonizedek (q.v.). The city was evidently not far from Lachish. It has been identified with the modern Khirbet Ajlan, 2 miles north of Tell el Hes, and with Tell Nejileh, 3 miles south of this place.

**EGMOND, COUNT.** See **EGMONT, LAMORAL**.

**EGMONT.** A tragedy by Goethe, published in 1788. Its plot centres about the revolution in the Netherlands in the middle of the sixteenth century.

**EGMONT, JOOST VAN** (1601-74). A Dutch portrait and historical painter, born at Leyden. He was a pupil of Caspar van den Hoecke and afterward studied under Rubens, for whom he painted the "Last Supper" in the cathedral at Malines. Later he went to Paris, worked with Vouet, and was appointed court painter to Louis XIII and Louis XIV. He was one of the first 12 members of the Académie Royale de Peinture, founded in 1648. In 1653 he returned to Antwerp, his son Constantine, with whom he is sometimes confounded, remaining in Paris. He designed many cartoons of historical subjects for tapestries and painted a large picture of the genealogy of the counts of Egmont, but is best known for his portraits in the style of Van Dyck. They include Philip IV of Spain and the Archduke Leopold Wilhelm (Vienna); Maria Aldegondé, Jan Cornelis, and Alexander Gouhon as children (Antwerp Museum).

**EGMONT, or EGMOND, LAMORAL, COUNT, PRINCE OF GAVRE** (1522-68). A Flemish general and statesman, born at the castle of La Hamaide in Hainault. He succeeded his elder brother

Charles in the title and estates in 1541, accompanied Charles V on the Algerian expedition in the same year, and followed that monarch afterward in all his campaigns against Francis I. His bravery and devotion were rewarded in 1546 with the order of the Golden Fleece. The year previously he had married Sabina of Bavaria, the sister of the Elector Palatine, with great pomp in the presence of the Emperor at Speyer. In 1554 Egmont was sent to England to negotiate the marriage between Mary and Philip. After the accession of Philip II he commanded the cavalry in the battles of St. Quentin and Gravelines (qq.v.); and when Philip finally returned to Spain, he left Egmont as Stadtholder of Flanders and Artois. When Margaret of Parma, against the will of the Protestant party, was made Regent General of the Netherlands, Egmont and the Prince of Orange entered the Council of State and opposed the ultra-Catholic policy of Cardinal Granvella and the Regent. On Egmont's threatening to resign Granvella was withdrawn from the Low Countries, and in 1565 the Count visited Philip at Madrid and departed homeward full of confidence in the King. But the reactionary edicts of Granvella were ordered to be enforced with more severity than ever, and the people were roused to rebel. When the insurrection broke out, Egmont opposed the Radical party, banded in the "Beggars' League," as it was called. He seems to have remained neutral even when, in April, 1567, his bitter enemy and rival, the Duke of Alva, was sent as lieutenant general to the Netherlands. (See **ALVA**.) The Prince of Orange and other chiefs of the insurrection left the country, while Egmont, wishing to save his private property, remained, thinking his loyalty and services had secured his safety. He appeared to have gained Alva's confidence, when suddenly, after a sitting of the Council, he and Count Horn were seized and carried to the citadel of Ghent. The Estates of Brabant sought to withdraw them from the Bloody Tribunal, as it was called, instituted by Alva, and Egmont, as a knight of the Golden Fleece, denied its competency. His Countess pleaded earnestly in his behalf, and intercession from the highest quarters was made to Philip. At his trial he was accused of having favored the enemies of the Catholic religion and of plotting the overthrow of the King. Ninety charges were brought against him, which he did not trouble himself to answer in detail, but protested his innocence, and showed clearly that he had been a loyal subject and faithful counselor of the King. Nevertheless, he was condemned to death by Alva and his tools, and on June 5, 1568, was executed in the great square of Brussels at the same time as Count Horn. Their death made them martyrs to the cause of liberty in the Netherlands, and in 1865 a monument by Fraiken was erected to their memory at Brussels. Goethe has made Egmont the hero of one of his finest tragedies. One of the best brief accounts of Egmont is given by Schiller in his *Abfall der Niederlande*. Consult: Motley, *Rise of the Dutch Republic* (London, 1861); Blok, *History of the People of the Netherlands*, vol. iii (New York, 1900); Juste, *Le comte d'Egmont et le comte de Hornes* (Brussels, 1862); De Bavay, *Procès du comte d'Egmont et pièces justificatives* (ib., 1853); also the published correspondence of Philip II and of Margaret of Parma.

**EGNATIA.** See **FASANO**.



**EGNATIS.** See GNATIS.

**E'GO** (Lat., I). A term much used by philosophers to denote the conscious self or person, especially when idealistically conceived as the metaphysical subject whose activity is supposed to give rise to the world of experience.

**E'GOISM.** A term formerly sometimes applied in philosophy to any view that was supposed to make the individual self the only reality knowable. It is now used almost entirely in an ethical sense as an antonym to altruism (q.v.). It denotes either the practical attitude which makes one's own private welfare the sole end of one's endeavor, or the theoretical view that such an end is the only one reasonable or possible. See ETHICS.

**E'GRET** (Fr. *aigrette*, diminutive of dialectic *égron*, OF. *hiron*, Fr. *héron*, heron). A name often given to various species of heron (q.v.), particularly those of white plumage which, at least during the breeding season, have the feathers on the lower part of the back lengthened and their barbs loose, so that this part of the plumage is very soft and flowing. These plumes are used for ornamental purposes. (See AIGRETTE.) In old English bills of fare the "egrittes" which are mentioned are not herons, but lapwings. Two species of egret are known in Europe—a large one (*Ardea alba*) and a small one (*Ardea garzetta*). In the southern United States three species of heron are known as egrets—the American egret (*Herodias egretta*), the snowy egret (*Egretta candidissima*), and the reddish egret (*Dichromanassa rufescens*). All three were formerly abundant to a remarkable degree in Florida, but are now rare, owing to persistent destruction of them in the breeding season for the sake of their plumes. Few chapters in American ornithology are so sad as the story of the slaughter of Florida's herons to supply the demands of an inexcusable and barbarous fashion. The setting aside by both the government and by private individuals of islands and large tracts of marshlands has probably insured the perpetuation of these beautiful birds. The reddish egret is of special interest because it illustrates the curious phenomenon known as *dichromatism*, some of the birds being pure white, while others are dark-bluish-slate color, and this difference does not seem to be connected with age, sex, or season. Consult Hornaday, *Our Vanishing Wild Life* (New York, 1913). See DICHROMATISM; HERON; and Colored Plate of WADERS.

**EGUISHEIM**, ä'gis-him. An archaeological station near Colmar, Alsace, at which fragments of a human skull of Neanderthal type were found. Consult, *Le préhistorique* (Paris, 1900).

**EGUSQUIZA**, ä'gōōs-ké'sä, JUAN BAUTISTA (1845- ). A South American politician and a president of Paraguay, born in Asunción. In the war against Brazil, Argentina, and Uruguay, he rose to be a lieutenant colonel. Subsequently he became Secretary of War and general. In 1894, following upon the summary deportation to Buenos Aires of President Gonzalez, he was elected President of the Republic for the term ending in 1898. His administration was in the main peaceful and progressive, although he so managed the dispute with Bolivia over the boundary line that war was averted chiefly by the success of the revolution that forced him out of office.

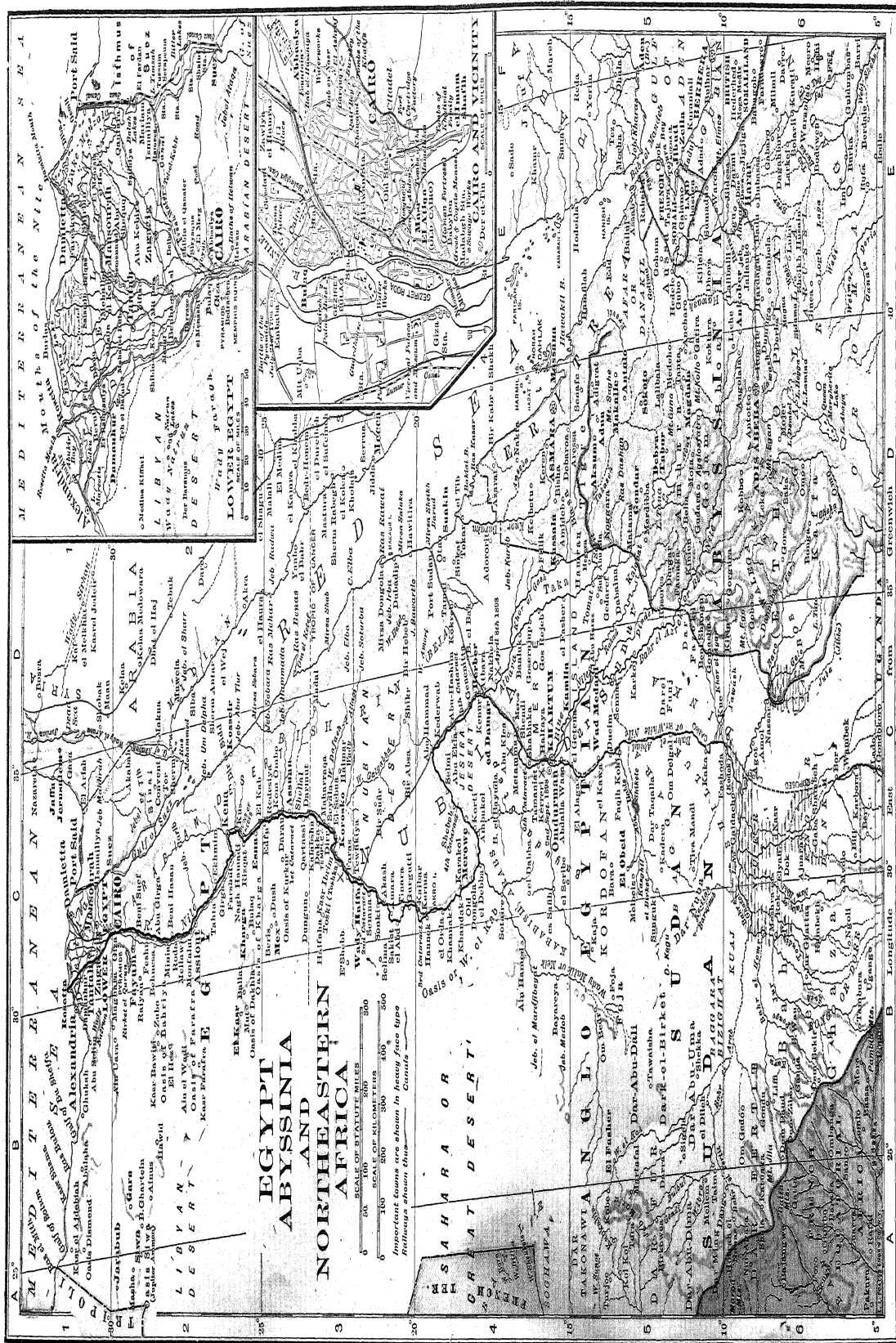
**EGYPT.** A country occupying the northeast corner of Africa. Egypt proper extends from

the Mediterranean south to lat. 22° N. (For an account of the agreement between the British and Egyptian governments, Jan. 19, 1899, see SUDAN, ANGLO-EGYPTIAN.) The boundary on the east is the Red Sea and on the extreme northeast Syria. This northeastern line falls within the Sinai Peninsula and was finally approved on Oct. 1, 1906, by a Turco-British convention. The west boundary separates Tripolitania from Egypt and is not yet (July, 1914) delimited, but negotiations between England and Italy are in progress for its final settlement. The oasis regions in the eastern third of the Libyan Desert belong to Egypt. The northernmost point of the country is in lat. 31° 40' N. Egypt thus extends 675 miles north and south, with a general breadth of about 500 miles. Its area is about 400,000 square miles, but the cultivated region in the Nile valley and Delta includes only about 10,000 square miles, about 9,000,000 people being crowded into a space about as large as the area of New Hampshire. About 92 per cent of the entire population consist of Mohammedans. The remaining 8 per cent consist of Christians and about 40,000 Jews. Of the Christian churches the Coptic Orthodox has by far the largest number of adherents,—about 665,000.

**Topography.** Egypt is a part of the great desert zone of North Africa. Four natural features distinguish parts of the country from the expanses of sand that stretch away in all directions. West of the Nile, in the barren wastes of the Libyan Desert, many little regions of depression occur where the surface is below sea level, or only a few hundred feet above it. Oases constitute the only centres of settlement in these regions. Their water is derived by infiltration from the Nile or from other sources of subterranean supply. Jof, in the Kufra group, was the home of the Senussi Mahdi, whose followers, in various parts of Africa and Asia, number some millions of Mohammedans. (See MOHAMMEDANISM; SENUSSI.) The second distinctive feature lies to the east of the Nile—a district of mountains. The roughly oblong piece of country between the Nile and the Red Sea, with Cairo and Suez as its northern, and Assuan and Berenice as its southern corners, is a mountainous desert, 150 miles broad, rising gradually from the Nile over sandy wastes and hills of secondary formation for 100 miles, where the elevation is about 2000 feet. Down the centre runs a main ridge or backbone of granite or primary rocks, from which the desert slopes more steeply and evenly to the sea. Clouds hang around the tops of these mountains in winter, and there is sufficient precipitation to provide water and herbage for the scanty flocks of the Bedouins. Along the Red Sea is a line of jagged mountains whose highest summit is about 7000 feet. The third distinctive feature lies south of Assuan—a region of desert hills and of pitiless sand plains, the northern part of the Nubian Desert. This district is bordered on the west by the Nile with its thin fringe of vegetation. The fourth distinctive feature is the valley of the Nile.

The First Cataract, the only one in Egypt, is just south of Assuan. The course of the Nile from the southern boundary of Egypt to the sea is about 800 miles. The Lower Nile, from Assuan to Cairo at the head of the Delta, is much visited by tourists. This riverain region, fertilized by flood waters and irrigation canals for







an average breadth of 9 miles, yields large crops. The Delta, from Cairo to the Mediterranean, covered with a network of navigable streams and irrigation canals, is the garden of Egypt. Most of the population and the chief rests are grouped here, with Cairo, the administrative centre, on one side, and Alexandria, the chief port and commercial centre, on the other. On the west side of the Nile, southwest of Cairo, is the depressed valley of Fayum, a fertile tract, in the northern part of which is the lake called Birket-el-Kerun.

**Climate.** In the southern part of Egypt there is considerable rainfall; over a large part of Lower Egypt there is practically no rain. On the immediate shores of the Mediterranean, however, there is some precipitation, owing to proximity to the sea. Thus, at Alexandria, on the coast, the rainfall is on the average  $8\frac{1}{2}$  inches, while at Cairo, at the head of the Delta, it is but 1 inch. There are great differences in temperature. Near the sea, where its influences are felt, the temperature rarely reaches the freezing point, while sometimes during the prevalence of the land wind from the south, the Khamsin, it has been known to reach  $114^{\circ}$  F. In Lower Egypt, where desert conditions prevail, great contrasts of temperature are observed. Throughout this region the air is extremely dry, and the sky is clear, the average annual cloudiness being not over 20 per cent. The winds blow from the north and northwest during the fall and winter, but in the spring and summer are often from the south. The hot south Khamsin blows chiefly during April and May. There are two seasons—a hot season from May to September and a cool one from November to March. October and April are transition periods. In the Nile valley distinction is made between the period of inundation from July to October; the planting season from November to March, and the summer from March to July.

**Flora.** The date palm and sycamore are the chief trees of Egypt, but all the tropical fruits which flourish in a dry climate are found. Among these are lemons, oranges, and figs. Tamarisks and thorny acacias occur in the less dry deserts. Egypt is renowned in the Levant for its vegetables, the country's damp soil favoring their growth admirably. Many species of trees have been introduced, and where they can obtain sufficient moisture they thrive well. There are no forests. Clover, grains, and cotton, the latter constituting the country's most important agricultural product, are extensively grown in the watered region, and in the Delta region rice and sugar cane. Tobacco might be a large crop, but its cultivation has been prohibited since 1890. Durra, the almost extinct papyrus, and the lotus are characteristic Egyptian plants. Many of the khedives have encouraged tree planting. A splendid shade tree known as the lebbek (*Albizia lebbek*) has been introduced in the valley of the Nile. It attains a height of 80 feet in half the number of years.

**Fauna.** Considered with respect to its animals, Egypt is essentially a part of Europe and not at all Ethiopian. It is, in fact, like the whole south shore of the Mediterranean, classed as a part of the Palearctic Province. (See DISTRIBUTION OF ANIMALS.) Perhaps no equally extensive part of the world has witnessed so great a change in its fauna as has occurred in the lower valley of the Nile during the 6000

years that it has been the seat of historical human occupation. Originally, no doubt, a large area, if not the whole breadth of the country on both sides of the Nile, was clothed with forests, which sustained a great variety of animals that disappeared with the destruction of the trees; and, on the other hand, some of the most characteristic of the animals of modern Egypt have become so only through man's occupation. Anciently many of the animals of the tropical Nile followed the river down to its Delta, including the elephant and hippopotamus. Crocodiles abounded within historic times, but have long been absent below the cataracts of the Nile. The river still furnishes a great variety of fish, few of which, however, are desirable for the table. Among them is the strange ganoid bichir (q.v.). Many varieties of waterfowl and wading birds, mainly the same as, or closely related to, European forms, move with the seasons up and down the river. Birds of prey are especially frequent in Egypt, where kites abound in the towns and do an important service towards keeping them clean. In winter hosts of familiar European birds are present. Several species of antelope, now becoming rare, such as the addax and oryx, approach the Nile from the Sahara. The wild ass is still to be seen in the remoter southern parts. Egyptian horses have an ungainly appearance, but are exceedingly hardy. Snakes are common, among them the deadly asp. The desert supports jackals and foxes (fennecs), and packs of striped hyenas haunt the caravan trails and neighborhood of rural villages. Lions are no longer to be seen except on the borders of the Sudan or in the rough mountains along the Red Sea near Abyssinia. Leopards are somewhat more numerous. Among the domesticated animals is the ichneumon. Camels are found in the large desert areas. Their flesh is highly relished in the flatlands. Oxen are used for plowing throughout Upper Egypt. Goats and fowls are very abundant.

**Geology and Mineral Resources.** Egypt has no geological features distinct from those common to the rest of Africa. The fundamental igneous and metamorphic rocks which underlie the horizontal strata of the Sahara and the Sudan extend across the Nile into the Arabian Desert and are prominent in the range of mountains lying along the western shore of the Red Sea. These rocks in many places support a sedimentary cap called the Nubian Sandstone, a formation that also appears in various localities on both banks of the Nile. In Lower Egypt Cretaceous and Tertiary limestones are extensively developed. The quarries of Egypt in ancient times produced great quantities of granite, porphyry, sandstone, and limestone, suitable both for building and for sculptural purposes; but they are now worked only intermittently. In other respects the mineral resources of the country are limited. The salt marshes of the Delta produce salt, soda, and alum, and some saltpetre is manufactured. The gold mines, which, according to ancient records, were worked as early as 2500 B.C., have been rediscovered in the crystalline rocks of the rugged mountains east of the Nile where abundant evidences of the old workings are found. Most of the auriferous quartz veins are found in the lower ranges. Petroleum has been discovered about 190 miles south of Suez close to the Red Sea coast. Copper mines, which are known to have been worked

by the Egyptian kings of the early dynasties, are known in the Sinai Peninsula.

**Agriculture.** Egypt is essentially an agricultural country, two-thirds of the inhabitants with declared occupations being engaged in farming. It differs widely in this respect from most other countries by reason of its dependence on the annual overflow of the Nile or artificial irrigation. (For a description of this river and its floods, see NILE.) Since the British occupation in 1882 progress has been made towards the full of the annual overflow, by the construction or improvement of huge dams, particularly the Barrage at the head of the Delta, which raises the level of the river and permits the perennial irrigation of a large part of the Delta lands. The soil, when irrigated, is of extraordinary fertility, owing to the amount of organic matter contained in the waters of the Nile. Three crops a year may be raised wherever perennial irrigation is supplied. The crops in the winter season (December to March), when the Nile carries water in excess of actual needs of agriculture, are wheat, beans, barley, vegetables, and clover. The crops of summer (April to July) are cotton, sugar cane, millet, rice, vegetables, and fruit. This is part of the season when the river is at its lowest. There can be little summer tillage excepting where perennial irrigation is supplied. The crops of the flood season are maize and millet. The total cultivable area in Egypt is about 8,000,000 acres, of which about three-fourths is cultivated, the remainder requiring irrigation or, in certain instances, drainage.

In the district of the Delta most of the cultivated area is under perennial irrigation, and where this exists three crops a year may be grown. The richest crops are raised in the Delta and in the Sefi (summer water) Canal areas of Upper Egypt.

Formerly a large share of Upper Egypt received its water supply by a division of the land into huge basins, formed by the construction of cross embankments extending from the river to the foothills. These basins were filled with the mud-charged waters during high Nile, and after the mud had settled, the clear water permitted to flow off, and the land, with its coating of new soil, cultivated. It often happened, however, that the supply of water for irrigation ran short in the season of low Nile, and barrages, or weirs, were constructed to deflect the waters from the natural course of the river to the basin areas under cultivation, this system having been successfully utilized in the Lower Nile by the barrage at the head of the Delta, about 12 miles above Cairo. It was subsequently found, however, that the water supply in the season of low Nile was insufficient to meet fully the requirements of the area occupied by the basins, and a great barrage was constructed at the First Cataract (see NILE), near Assuan, about 550 miles by rail south of Cairo. This great work, known as the Assuan Dam, was completed in 1902 at a cost of \$10,000,000 and created a lake or reservoir about 200 miles long in the valley of the Nile above the First Cataract, the storage of the waters being begun only after the early portion of the flood with its supplies of new soil had passed to the basin lands. (See DAMS AND RESERVOIRS.) The storage capacity was estimated at 3,750,000 million cubic feet. Even this supply, for use during the later months for perennial irrigation purposes, proved in-

sufficient, and the dam was raised 27 feet, this work being completed in December, 1912, and increasing the estimated storage capacity of the great reservoir to about 9,000,000 million cubic feet. It is expected that this retention of the surplus water, for use when required and thus giving perennial irrigation to a large share of the Upper Nile region, will increase its production fully 50 per cent. The system did not fully meet expectations in 1913, owing to the fact that the Nile floods were unusually late and the supply of water less than usual. There has also been difficulty in educating the native population as to the amount of water which may advantageously be used. Drainage works, being introduced in Lower Egypt to make available certain areas occupied by shallow lakes, will further increase production. In the broadest sense the staple crops are cotton in the Delta and cereals both in the Delta and in Upper Egypt. Egyptian cotton has been recognized since 1821 as supplying a long fibre unsurpassed in quality except by American Sea Island. The crop, about one-tenth as large as that of the United States, is in demand in all manufacturing countries for the finer qualities of goods in which strength and lustre of fibre are required. Cotton culture is rapidly extending in Upper Egypt, but three-fourths of the crop is still in the Delta. The cotton crop has suffered in late years from insect pests, due in part to the destruction of bird life, also from the lack of proper selection of seed. The production amounts to about 750,000,000 pounds per annum, valued at approximately \$150,000,000. Raw silk is produced to a small extent. The rice crop is diminishing in most districts; it is barely profitable. When the extensive salt lands in the Delta along the Mediterranean shall have been reclaimed, it is expected that Egypt will grow all the rice needed. At present large quantities are imported. Wheat and maize are very large food crops, the surplus being sent to Europe. The wheat area is about equally distributed between the Delta and the rest of Egypt, but maize culture predominates in the Delta.

In regard to the form of tenure the land is divided into three classes: (1) the Kharaji, or land owned by the state, comprising about three-fourths of the land under cultivation, mostly rented in small parcels to the natives; (2) the Ushuri, or land originally granted in fee to large landholders, comprising less than one-fourth of the cultivated land, subject to a tax equal to about one-third of the rent paid by the fellahs, or tenantry; (3) the Wakf lands, or lands belonging to the mosques and charitable institutions, and rented by them, usually for long terms. In the first half of the nineteenth century, when the treasury was impoverished by the immense expenditures on public works, the fellahs, besides being compelled to do forced labor on public works, were also forced to pay a burdensome rent in kind and to sell their crops to the government at prices arbitrarily fixed by the Pasha. At present the rent is paid in money, and the farmer is in no way interfered with in the disposal of his crop. The large indebtedness of the agricultural population seriously affects the agricultural conditions of the country. Although the legal rate of interest is only 9 per cent, the rate exacted by the money lenders is much higher. Measures have been taken towards the elimination of usury by allowing the National Bank to advance small sums to



the farmers at 10 per cent, and, judging from official reports, this policy seems to have been sufficiently successful to warrant its extension. The distribution of land in 1911 was as follows: Of the 1,441,250 holdings, 1,296,561 contained 5 feddans and under (a feddan equals 1.038 acres); 76,382 contained between 5 and 10 feddans; 36,461, between 10 and 20 feddans; 11,188, between 20 and 30 feddans; 8,265, between 30 and 50 feddans; and 12,393, over 50 feddans. The area devoted to wheat in 1912 was 1,447,000 acres, and the yield 4,205,000 tons; barley, 382,327 acres, 1,234,000 tons; maize and millet, 1,925,000 acres, 9,353,000 tons; the sugar exports amounted to £E. 182,306, raw cotton £E. 27,529,000, and cotton tissues £E. 3,500,000 (Egyptian pound, \$4.943). There are over 5,000,000 date trees, which, besides supplying the home demand, yield some fruit for export. The domestic live stock of the country is increasing in number and includes nearly 1,000,000 sheep and goats (some wool is exported), 500,000 cattle and buffaloes, and 50,000 camels; while horses, mules, and donkeys are found in every city and village. Hogs are raised by the Copts of Upper Egypt and bought by Greek and German butchers to sell to European residents.

An important event in 1913 was the enactment of the "Five Feddan" law, which laid down that distraint could not be levied against the agricultural property of cultivators consisting of 5 feddans or less, the purpose being to protect this class against exorbitant demands of small foreign usurers scattered throughout the country.

**Manufactures.** Egypt has few manufacturing establishments, and the weaving of linen and fez, which dates from an early time, is in a state of decline. There are a number of sugar refineries worked by foreign capital, Egypt having become a sugar-exporting rather than an importing country. A few cotton mills are also operated. The making of Egyptian cigarettes is a large export industry. Tobacco growing is prohibited, both to prevent the use of inferior home-grown leaf in the cigarette factories and also to increase the import revenues. Export cigarettes are made chiefly of Turkish tobacco. The value of cigarettes exported in 1912 was approximately \$2,000,000. During the reign of Mehemet Ali a number of state industrial establishments were founded, but most of them have been closed.

**Transportation and Communication.** Almost the entire foreign trade of Egypt passes through Alexandria, the shipping of that port in 1911 amounting to 6,800,000 tons, including both entrances and clearances, about 43 per cent of which is carried in British bottoms. The railway lines of Egypt, with the exception of eight agricultural roads built for service on farms, are owned by the government. At the beginning of 1911 there were 1481 miles of railway owned and operated by the state, and 763 miles of agricultural roads in private hands. Traffic on the state lines shows a decided increase. In 1911 the number of passengers carried on the state railways was 27,941,000; the tons of freight were 4,313,501; the net receipts were £994,000 (Egyptian). In 1904 the respective figures were 17,724,924, 3,529,600 tons, and £1,233,300 (Egyptian). The agricultural roads have increased rapidly in number during recent years, with great benefit to agricultural communities. A department of roads was established in 1913 with the object of developing

highways over which motors could be used for commercial and general transportation in the absence of animal power. See SUEZ CANAL.

**Commerce.** Egypt has acquired considerable importance in the world's commerce on account of its geographical situation. The advantages conferred by its site render its northeastern section the most important point on one of the world's longest sea routes in addition to its being the connecting stage of the land route between Asia and Africa. Cairo (q.v.) is the meeting place of all caravans, whether religious or commercial, that ply between the two continents. Ivory, ostrich feathers, and hides are thus brought to Egyptian bazars from the interior of Africa. Alexandria is the natural seaport for communication with Europe.

The economic development of Egypt under the British rule, brought about by the improvement in transportation and irrigation facilities and the readjustment of the finances, is probably best shown by the increase in its foreign commerce. During the period 1896-1912 the exports of merchandise increased from £E. 13,232,108 to £E. 34,574,321, while the imports increased during the same period from £E. 9,828,604 to £E. 25,907,759. Naturally Great Britain occupies the foremost position among countries trading with Egypt. The imports from Great Britain rose from £E. 3,056,000 in 1896 to £E. 7,990,658 in 1912. In the exports Great Britain's share is even larger, the exports to Great Britain increased during 1896-1912 from £E. 1,000,000 to £E. 16,022,318. The imports from the United States amounted in 1912 to £E. 403,525, and the exports to £E. 4,120,895. The chief exports are cotton, £E. 27,529,271 in 1912, cereals and vegetables, £E. 2,730,469, and cigarettes, £E. 422,866. The chief imports were in 1912: textiles, £E. 6,907,673; cereals and vegetables, £E. 3,066,000; metals and manufactures, £E. 2,921,896; wood, coal, etc., £E. 3,062,000. The magnitude of the cotton exports usually turns the so-called balance of trade in favor of Egypt. The cotton goes mostly to Great Britain, from which are imported chiefly cotton goods, wood and coal, metals, and metal products. The quantity of Egyptian cotton imported into the United States in 1913 was approximately 100,000,000 pounds, valued at about \$20,000,000. Marseilles buys most of the cottonseed. The commercial relations of Egypt are important also with Turkey, France, Algeria, and Austria-Hungary. As the industrial development is small, the imports of textiles (over one-fourth of all foreign imports) and other manufactures are very large. As Egypt has no forests, timber and lumber from northern Europe and Austria-Hungary are important. The United States buys Egyptian cotton to the value of 10 times that of the goods it sells direct to Egypt, though some products of the United States reach Egypt by way of England and Germany. The foreign commerce is principally in the hands of Europeans, the natives confining themselves to the internal trade.

**Government.** Egypt is a tributary state of Turkey, but the office of Governor-General or Khedive is vested permanently in the descendants of Mehemet Ali, who was appointed Governor of Egypt in 1805 and succeeded in making himself independent ruler of the country. In consideration of an annual tribute of £750,000 Turkish (a Turkish pound is \$4.40), the Khedive formerly enjoyed absolute rule in Egypt in spite of the presence in his council of a high

commissioner from Constantinople. Absolute legislative and administrative power was formerly vested in the Khedive and a council of six native ministers under his control. In 1913, however, a new system was introduced, upon the recommendation of Lord Kitchener, the British agent and Consul General, with a Legislative Assembly of 89 members, of which three-fourths are elected by district electors chosen by popular vote in proportion to population; the 23 appointive members to include four Copts, three Bedouins, two merchants, one engineer, one pedagogue, and one municipal representative. This body is to have actual legislative functions, those of the former Assembly having been nominal and merely advisory in character. The new Legislative Assembly was opened in January, 1914, in the presence of the Khedive, Lord Kitchener, and with messages of congratulation from the British King and others of authority. The ministers preside over the departments of the Interior, Finance, Justice, Public Works and Instruction, War and Marine, and Foreign Affairs. The most important offices in the ministerial departments, and especially in the departments of Public Works and Finance, are filled by Europeans. Between 1879 and 1883 England and France jointly exercised a guiding influence on the administration of the country through their controller of the two nations having intervened in affairs for the protection of their bondholders, whose interests were threatened by the state of disorder prevalent in Egypt. The rebellion of Arabi Pasha was followed by the abolition of the joint control of the two nations, and by the appointment of an English financial adviser, whose consent was necessary to all fiscal action. Since that time the financial adviser has steadily increased his powers, until now, through the importance of his office, he is practically the ruler of the country.

The influence of England is also made predominant by the control of the public defenses. The Egyptian army has been drilled by English officers and is in a great measure commanded by them, the head of the national forces being an English general bearing the title of sirdar. Besides the regular Egyptian army there has been in the country since 1882 a British army of occupation, towards the support of which the government of the Khedive contributes in part. The British garrison or army of occupation includes four battalions of troops in the Delta and one battalion in the Sudan. There is one regiment of cavalry, a horse artillery battery, a mountain battery, and a company of engineers. The Egyptian government contributes £E. 150,000 towards the cost of these troops. Egypt proper is divided into 5 governorships and 14 mudirihs or provinces, which in turn are subdivided into districts and communes. At the head of the province is the mudir, who is assisted in the performance of his various functions by a sanitary board, a police bureau, and a chief engineer. He also exercises authority over the heads of districts and communities, which in turn exercise control over the representatives of the villages and municipal wards. The collection of taxes is carried on through the mudir.

**Finances.** The administration of the finances of Egypt may be said to be entirely in British hands, for while the Caisse de la Dette, which has charge of the payment of the foreign debt of Egypt, contains representatives of all the great

European powers, the British financial adviser has control of the country's finances. In evidence of the improvement in financial conditions, it may be stated that the receipts have exceeded the expenditures since 1888, leaving a considerable surplus which is now used for public works, such as irrigation, railways, etc. The chief sources of revenue are land taxes, about 45 per cent of the total, and taxes on tobacco and salt, public works and customs. The chief items of expenditure are the service of the debt (about £3,500,000 Egyptian), the costs of administration, and the operation of public works. The revenue now regularly exceeds the expenditure, notwithstanding the abolition of the provincial octroi in 1901 and an increase in railway expenditures. In 1912 the revenue was estimated at £E. 15,900,000 and the expenditure £E. 15,400,000. The foreign indebtedness of Egypt dates from 1862, when a loan of £3,292,800 was issued for the purpose of floating the floating debt. By 1870 the debt had been increased to £38,307,000 and was subsequently increased by a new loan of £32,000,000 issued in 1873. In 1876 the several issues were consolidated into one debt of £91,000,000. Owing to subsequent financial difficulties, the debt was again divided into a preference debt of £17,000,000 at 5 per cent and a unified debt of £59,000,000 at 7 per cent while the Daira loans were consolidated into the Daira Sanieh debt of £8,815,430 at 5 per cent. The Daira Sanieh debt was paid in October, 1905. Since the passing of the financial control into the hands of European powers many changes have been made in rates of interest, and a number of new loans have been issued. In 1912 the foreign debt consisted of the 3 per cent guaranteed loan of £7,318,500 (English); the privileged debt of £31,127,780 at 3½ per cent; the unified debt of £55,971,960 at 4 per cent; and the domains loan of £203,420 at 4½ per cent. Reserve funds, established in 1887, amounted in 1911 to £5,847,612 (Egyptian). On Jan. 1, 1913, the debt stood at £E. 94,349,680.

**Justice.** Justice is administered by four classes of tribunals. There are (1) the native courts, which deal with civil actions between natives and with crimes committed by natives; (2) the consular courts, which exercise jurisdiction in the case of foreigners accused of crime; (3) the mixed tribunals, which date from 1875 and try all civil actions between persons of different nationalities and, in a measure, criminal actions against foreigners. The mixed tribunals, which were created by international action, are renewed every five years. Finally, there are (4) the Mohammedan courts, conducted according to the precepts of the Koran and the general code of the Mohammedan religion. These courts deal chiefly with the questions of personal rights of the Mohammedan inhabitants. The system of native courts comprises seven courts of the first instance for the trial of important cases, 47 summary tribunals for the hearing of cases of minor importance, and a court of appeal at Cairo, about one-half of its members being Europeans. The native judges are drawn from the class of the Ulemas, or those learned in the Mohammedan law. Some attempt towards the systematization of the native jurisprudence has been made in the publication of a code of laws, which was in the main a blending of religious precepts with secular law. The administration of justice in the lower courts is

under the supervision of a judicial committee, to which the judges or kadis are responsible for their action.

**Population.** The population of Egypt in 1846, 1882, and 1907 was respectively 4,476,440, 6,813,919, and 11,287,859, the average annual increase being 1.25 per cent for the period 1846-82 and 2.76 per cent for 1882-97. Of the total population in 1907, 10,366,826 (7,381 nomads) were Egyptians who constitute the great bulk of the people; Arab inhabitants of the towns, and Bedouins and Copts), 62,973 Greeks and Tunisians, 34,926 Italians, 20,653 British and Maltese, 14,941 French, 69,725 Turks, and 65,162 Sudanese. There also are a large number of other nationalities. The population in the villages and smaller towns is purely Egyptian, while in the larger towns Arabs and foreigners predominate. The census of 1907 gave the population of the principal cities and towns as follows: Cairo, 654,476; Alexandria, 332,246; Port Said, 49,884; Assiut, 39,442.

**Religion.** About 10,366,826 inhabitants, or 92.23 per cent, profess the Sunnite Mohammedan faith; 706,000 are Copts (q.v.), 77,000 Greek Orthodox, 128,000 Eastern Christians, 58,000 Roman Catholics, 28,000 Protestants, and 38,635 Jews, these figures being those of the census of 1907. The Armenians have a bishop in Cairo. The Maronites are also represented. The Roman Catholics have two churches in Alexandria and two in Cairo. Missionary

The Copts are bigoted and exclusive and not well disposed towards other Christian bodies. There is an American mission at Alexandria and Cairo, which works chiefly among the Copts and Jews. A training school was established at Assiut in 1865. Various Roman Catholic organizations, such as the Christian Brothers, Sisters of Charity, and Poor Clares, are doing much in the way of charitable and benevolent work.

**Education.** Education among the natives is in a very low state. In 1907 about 8.5 per cent of the males and about 3 per cent of the females of the native Egyptian population were able to read and write, while the proportion among the Coptic male inhabitants was approximately 50 per cent, and among foreign inhabitants 74 per cent. Elementary education among the Mohammedans is mainly in the hands of private teachers or is provided for by schools attached to the mosques. At the head of the Mohammedan educational system is the great theological seminary at the mosque of El-Azhar, the oldest and greatest university in the Moslem world. (See CAIRO.) The subjects on which instruction is given are the old traditional branches of Arabic, Islamic law, and the system of pedagogy is as antiquated as the studies which are pursued. Schools attached to mosques, and known as Kuttabs, exist in all cities and towns. The government extends certain supervision over these. The instruction is elementary, a part being memorization of parts of the Koran. An attempt to institute a system of public schools, made by Mehemet Ali, succeeded only in part. In 1907 there were about 12,000 elementary schools in the country, with approximately 17,000 teachers and about 250,000 pupils, and 20,000 attended the mission schools supported by the various creeds—Roman Catholic, Greek Orthodox, the United Presby-

terians of America, and others. In furtherance of a policy of coöperation between the Ministry of Education and the provincial councils the latter are assuming charge of all elementary and primary schools and the former all secondary institutions. In 1912 there were under direct control of the Ministry of Education 208 establishments, with about 25,000 pupils, of whom one-fifth were girls. Those under inspection by the ministry numbered nearly 4000, with an attendance of 228,000, of whom about 10 per cent were girls. The vast mass of students of all grades, therefore, still receive instruction at the hands of Mohammedan religious instructors.

**Army.** The present Egyptian army was organized in December, 1882, by a British general officer under the title of sirdar. The army consists of a little over 18,000 men, with whom there were serving in 1910 about 140 English officers. About 6000 British troops are permanently garrisoned in Egypt, to meet the cost of which the Egyptian government is required to pay \$741,000 annually.

#### ANCIENT EGYPT

**The Land.** To the ancients Egypt was that portion of the Nile valley extending from the First Cataract (lat. 24°), near Syene, on the south, to the Mediterranean on the north. On either side the land is shut in by rocky ridges, which extend on the east to the Arabian, on the west to the Libyan Desert. Somewhat to the north of lat. 30° these ridges open out to the northeast and northwest respectively, bounding a district which, from the resemblance of its outline to the fourth character in the Greek alphabet, was called the Delta. Through the Delta the Nile flowed into the sea by separate mouths. Ancient writers enumerated seven such mouths, but the course of the river has shifted repeatedly into new channels, and at present there are but two mouths, situated at Damietta and at Rosetta. The Egyptians called their land *Qémet*, 'the black land,' from the contrast between the dark alluvial soil and the red sand of the adjacent deserts. The origin of the Greek name *Αἴγυπτος* (whence Latin *Egyptus* and our *Egypt*) is obscure. The land was divided into Upper Egypt, called 'the south,' *Qema*, or 'the south country,' *Ta-res* (later *Pa-ta-res*, whence the biblical *Pathros*), and Lower Egypt, including the Delta (*Ta-meh*). In the earliest historical period Upper Egypt contained many marshy tracts, later filled up by alluvial deposits, and the Delta, the name of which was given to this portion of Egypt by the Greeks, which even now has a thin soil, was one vast marsh, though it afforded good pasturage for cattle and was a favorite resort for hunting wild fowl. In the course of time the constant deposits of alluvial matter considerably increased the area of arable land both in the north and in the south, but from the first the conditions were more favorable for agriculture in Upper than in Lower Egypt, and in the time of the Old Empire the Delta was far behind the southern part of the country in civilization. Upper Egypt was early divided into some 20 provinces, or counties, called *nomes* (*νομοί*) by the Greeks, which probably represent tribal divisions, and later, in obvious imitation of this division, a similar number of *nomes* is found in Lower Egypt as well. At times the number of the *nomes* varied, but in general it was from 40

to 42. The capitals of the nomes were each the seat of a particular divinity or group of divinities. How the boundaries of these nomes were determined is unknown.

**Ethnology.** The ancient Egyptians believed themselves to be an indigenous people, free from all foreign admixture, and all the known facts tend to favor their contention. Both their language and their physical characteristics show that they belonged to the Hamitic branch of the Caucasian race, the white inhabitants of northern Africa. They represent this race very purely; the admixture of Semitic and negro blood is not considerable. Their relatives are the Berbers of northern Africa and the Bisharis, Gallas, and Somalis, of eastern Africa. The evident relationship subsisting between Egyptian and the Semitic languages has given rise to several theories. Some scholars (e.g., Wiedemann and D. M. Brown) believe that the Egyptians and the Hamitic race entered Egypt in prehistoric times from Asia into Egypt. Others hold that at some remote period the Nile valley was invaded by Semites, who, though few in number, were able to conquer the country and to impose their language on the conquered people. According to this theory the Egyptians were, to use Erman's own expression, "Semitized Nubians." Other scholars (as Palgrave, Brinton, and Keane) hold that the ancestors of both Semites and Hamites originally dwelt together in northern Africa, whence the former emigrated at a very remote period into Arabia. A very clear summary of the whole argument is to be found in Barton, *A Sketch of Semitic Origins* (New York, 1902). The weight of evidence seems to be rather in favor of the last hypothesis. The Hyksos invasion led apparently to little intermingling of races, but under the New Empire there was some infusion of Semite blood, especially from the slaves captured in the Asiatic wars. Under the Twenty-second dynasty the Libyans contributed an important element to the population, and the Ethiopians (dynasty Twenty-five) probably added some Nubian elements. The Assyrian rule was of a very temporary character, and neither this nor the Persian dominion affected the population appreciably. Under the Ptolemies there was a considerable influx of Greeks, especially into the Delta and the Fayum, and many Jews settled in the commercial cities. The Mohammedan conquest in the seventh century A.D. brought a large Arab population into Egypt, which later received additions from the Tatar Turks. In spite, however, of all this, the old type maintained itself with considerable purity, and the Egyptian fellah of the present day is the true descendant of his forefathers under the early Pharaohs. Consult Roeder, "Der gegenwärtige Stand der Ägyptologie," *Prähistorische Zeitschrift* (1912), pp. 419 ff.

**Government and Administration.** It has been conjectured that the nomes, or provinces, of ancient Egypt represent the remains of a number of independent states, or tribes, which in course of time were brought together under a central authority. It is not improbable that such a condition actually existed, but, if so, it must have been at a very remote period of antiquity. Long before the beginning of the historical period Egypt had advanced to another stage of political development, and consisted of two kingdoms, the Delta and the South, with their frontier not far from Memphis. These two

kingdoms were united into a single monarchy before the time of the earliest monuments; but the memory of the union was preserved in the titles of the Egyptian kings down to the period of Roman dominion. As in other Oriental countries, the government of Egypt was, in theory at least, an absolute despotism; the will of the King was law. But in practice this was modified by various circumstances. At times, as in the Middle Kingdom, the great nobles became almost independent of the crown, and the central power was correspondingly abridged; and later the ecclesiastical power encroached upon the royal prerogative until it finally usurped the whole authority.

Under the Old Empire the government of Egypt was organized on the basis of a great bureaucracy. The various governmental departments, at the head of which stood that of the Treasury, were systematically arranged and there was a regular gradation of officials, each intrusted with specific duties, and each directly responsible to his immediate superior. The government was administered by a Vizier or, at times, by two such officers representing Upper and Lower Egypt respectively. The nomes, however, occupied a somewhat peculiar position. Each nome had to a large extent its own internal administration and formed a copy in miniature of the state. It had its own treasury, its own courts of justice, and its own militia. The nomarchs, or rulers of nomes, were the heads of ancient noble families possessing large landed estates and numerous special privileges. In the troubled period which followed the close of the Old Empire they took advantage of the weakness of the central power to make themselves practically independent princes. In this way there arose a feudal system similar to that which prevailed in mediæval Europe. The nomarchs of the Middle Empire acknowledged the King as their suzerain, but they were no longer his servants. Amenemhat I, the founder of the Twelfth dynasty, was partly successful in his effort to curb the power of these haughty nobles; but he was never able to bring them into complete subjection, and they maintained their power and their privileges down to the time of the Hyksos War. But though the bureaucratic state of the Old Empire gave way to the feudal state of the Middle Empire, there was little change in the external form of the government, and the Treasury Department, at least, with its numerous and varied administrative functions, remained unchanged.

The Eighteenth dynasty established a new order of things. The old turbulent nobility had been swept away in the Hyksos wars, their estates had fallen into the hands of the crown, and the nomes were administered by royal governors. The feudal system of the Middle Empire gave way to a highly centralized military government. At the same time there was another important feature. Under the New Empire the priestly class rose greatly in importance. The immense booty derived from the Asiatic wars was lavished upon the temples, which at the same time acquired extensive landed estates. This was notably the case with priests of the god Ammon of Thebes, and the great wealth thus accumulated gave the Theban hierarchy so overwhelming an influence that they were at last able to overthrow the royal authority and to establish a priestly dynasty (the Twenty-first), ruling upon theocratic principles. In the meantime the

army, largely composed of mercenary troops, had gained in power and importance. Many of the chief offices of the state fell into the hands of military officials, and finally the Libyan mercenaries under Sheshonk drove out the priest kings, and established dynasty Twenty-two.

From a very early period the system of laws was highly developed, and the administration of justice played an important part in the state. Diodorus states that the Egyptians possessed sacred books of laws the contents of which they ascribed to the god Thoth, and that other laws were enacted by various monarchs. No collections of laws have been preserved, though a number of papyri give information as to legal procedure in particular cases, both civil and criminal. Each nome had its own court over which the nomarch presided. There were also under the Old Empire six courts of wider jurisdiction, known as the Six Great Houses, composed of high nobles with the Vizier at their head as chief justice. Under the New Empire the Vizier was still the chief justice by virtue of his office, but the institution of the Six Great Houses no longer existed. There were, however, district courts throughout the land. They were composed of certain high officials, and the Governor of the district usually presided. From the decision of these courts there was an appeal to the King. The judges were at all periods under the special protection of Ma'at, the goddess of truth and right; they wore her image when on the bench, and many, if not all of them, were her priests. The punishments for crimes and misdemeanors varied in degree from beating upon the hands and feet or degradation from office or mutilation such as the cutting off of the nose, to death by one's own hand or by starvation.

**Language.** Egyptian belongs to the Hamitic family of speech, of which the principal modern representatives are the Galla, Somali, and Bishari of eastern Africa, and the Berber languages, of northern Africa. Egyptian itself shows an undeniable relationship to the Semitic languages, though it is not yet determined whether this relationship depends upon an early conquest of the Nile valley by Semites, or upon a primitive kinship between the peoples of the Hamitic and Semitic stocks. The oldest monuments of the Egyptian language go back to about 4000 B.C., and it did not die out as a spoken language until about three centuries ago. In the course of its long history it naturally underwent many changes. The language of the Old Empire, e.g., was no more intelligible to an Egyptian of the Nineteenth dynasty than Latin would be to the average Italian of the present day. Egyptologists distinguish the following chief periods of the language: 1. Old Egyptian, the classical language of the Old Empire. Long after it had ceased to be spoken it led an artificial existence as a learned language, playing much the same part as Latin played in mediæval Europe, and was regularly employed for religious and monumental purposes down to the Roman period. Careful philological training was not, however, a distinguishing characteristic of the Egyptian scribes, and therefore texts composed in Old Egyptian after 1000 B.C. are all bad imitations of earlier monuments; those written after 500 B.C. are barbarous. The best grammar of Old Egyptian is Erman, *Altägyptische Grammatik* (Berlin, 1894; Eng. trans., London, 1894). 2. Middle Egyptian, the popular language of the Middle Empire. It rep-

resents an intermediate stage between the language of the Old and that of the New Empire. Most of the old forms and inflections are retained, but some of the peculiarities of the later speech begin to make their appearance. This stage of Egyptian is treated by Erman in his *Die Sprache des Papyrus Westcar* (Leipzig, 1889). 3. Neo-Egyptian, the popular language of the New Empire (about 1500-1000 B.C.). It is represented by a considerable number of papyri written almost exclusively in the hieratic character, and containing chiefly tales, poems, letters, and legal documents. This period of the language is exhaustively treated in Erman, *Neuägyptische Grammatik* (Leipzig, 1889). 4. Late Egyptian, the popular language in use from about 700 B.C. to the Christian era. It is often called demotic, but this is not strictly correct, since the term "demotic" properly designates, not the language of this period, but the script in which it is written. Late Egyptian is represented by a large number of papyri written in the demotic script. They contain chiefly legal and commercial documents, letters, and magical texts, together with a few tales. There is no good treatment of this subject. The best is by Brugsch, *Grammaire démotique* (Paris, 1855), but that is antiquated. 5. Coptic, the language of Christian Egypt and the latest descendant of Old Egyptian. It is written in a modification of the Greek alphabet with the addition of some characters derived from demotic, and in its vocabulary it has borrowed freely from the Greek. A number of local dialects may be distinguished. As a spoken language, it died out only about 300 years ago, and it is still employed as the ritual language of the Coptic church. Coptic possesses an extensive literature, which is almost entirely of a religious character and includes many translations from Greek works. The standard grammar of the language is Stern, *Koptische Grammatik* (Leipzig, 1880). Steindorff, *Koptische Grammatik* (Berlin, 1894), is, however, better adapted to the needs of beginners. Both Erman's *Altägyptische Grammatik* and Steindorff's *Koptische Grammatik* contain useful bibliographies, which together cover all the periods of the language.

In Egyptian, as in the Semitic languages, triconsonantal stems prevailed, though even in the oldest texts many stems had been reduced by corruption to a biconsonantal scheme. Quadriliterals and quinquiliterals were formed, chiefly by partial reduplication. As in Coptic, each word had but one full vowel, which stood either in the penult or ultima. In closed syllables it was short; in open syllables it was long. The accent of a word rested upon the syllable containing the full vowel. As in Semitic, each word or syllable must begin with a consonant. The language possessed both independent and suffixed personal pronouns, which were employed much as in Semitic. The number of the demonstrative pronouns is considerable. In Old Egyptian there was no article: the definite article first comes into use in Middle Egyptian, and the indefinite article in Neo-Egyptian. In the substantive and in the verb two genders were distinguished—masculine and feminine, the latter standing also for the neuter. As in Semitic, the feminine ending of the substantive was *t*. There were three numbers—singular, dual, and plural, each distinguished by special endings, but the dual early became obsolete. The old inflection of the verb, formed by the addition of certain

pronominal endings to the stem, resembled the Semitic perfect and distinguished, apparently by difference of vocalization, an active-passive and a passive-intransitive form; but the former was almost obsolete at the time of the earliest texts. The later inflection was formed by suffixing a personal pronoun to a participial form. Both active and passive forms are distinguished. Auxiliary verbs are found in the oldest texts; in the later stages of the language they are employed with increasing frequency, and in Coptic, with the exception of a few survivals, conjugation by means of auxiliary verbs in combination with the infinitive or participle has entirely supplanted the older modes of inflection. A causative was formed by prefixing *s* to the stem, and it is probable that other derived conjugations may have existed at a very remote period. There are, at least, traces of a reflexive form with prefixed *n*, like the Semitic Niphal. The verb also formed a participle, an imperative, and an infinitive; the last named had both masculine and feminine forms and was treated like a noun. The genitive relation was originally expressed by simple juxtaposition, the accent, as in the Semitic construct connection, shifting to the second word. It was later expressed by means of a particle (originally a demonstrative pronoun) placed before the *nomen rectum*. The structure of the sentence was generally simple. The prevailing order was verb, subject, direct object, indirect object. This, however, might be modified by special circumstances. A pronoun, e.g., preceded a noun, and a word might be placed out of the usual order for the sake of emphasis. Consult, in addition to the grammatical works cited above, Sethe, *Das ägyptische Verbum* (Leipzig, 1899-1902), and Erman, "Die Flexion des ägyptischen Verbums," in *Sitzungsberichte der königlichen preussischen Akademie der Wissenschaften zu Berlin*, vol. xix (1900).

**Writing.** The hieroglyphic system of writing was believed by the Egyptians to have been invented by the god Thoth, who instructed the inhabitants of the Nile valley in its use. It is found fully developed on the most ancient monuments and continued to be used for monumental inscriptions down to the Roman period. The latest hieroglyphic inscription dates from the year 250 A.D. (See ESNE.) The individual characters or hieroglyphs are pictures of men, animals, plants, weapons, implements, and other objects. Their number is very large, though only about 500 are in frequent use. As regards their employment, they naturally resolve into three classes: 1. Phonetic signs, which are either alphabetic or syllabic; i.e., they stand either for a single consonant or for a syllable. 2. Ideograms, which properly represent each a particular word, but are frequently used, in a purely phonetic manner, to represent any word having the same group of consonants. 3. Determinatives, or signs placed after words to indicate their meaning in a general way. For example, verbs of motion were determined by a pair of legs; names of animals, by the picture of a hide with the tail attached. The determinatives were not pronounced, but merely served as an indication to the reader. The prevailing orthography required that each word should be written by means of its ideogram (if it had one), and to this was added an indication of the pronunciation in phonetic characters. Sometimes the whole word was thus spelled out. As

in all ancient systems of writing, except the Assyro-Babylonian cuneiform, only the consonants were written, the vowels being left for the reader to supply. (See HIEROGLYPHICS.) While the hieroglyphics were well adapted for monumental inscriptions cut in stone and lent themselves admirably to decorative effects, they were very unwieldy where rapidity was essential. At a very early period, therefore, another kind of script, called the hieratic, came into use for writing on papyrus. The same characters were used, but in a more cursive form; only the essential features of the ' ' ' ' are retained, and these were ' ' ' ' by a few strokes. Hieratic, therefore, differs from hieroglyphic writing in much the same way that our written letters differ from print. While this style is encountered as early as the First dynasty, there was a constant tendency to give the hieratic a more cursive form when applied to business and other practical purposes, and this tendency resulted, about 700 B.C., in the development of a new script, called the demotic, or popular, writing. Demotic was simply a very cursive script and was developed from hieratic just as this was developed from hieroglyphic writing. It was in general use for papyri of a secular character as late as the Roman period. The most recent demotic text dates from the fifth century A.D. Throughout all these changes the system of writing remained the same; it was merely the forms of the characters that were altered. All three forms of writing normally run from right to left, although for special causes the direction could be reversed. In the second century A.D. the Egyptians seem to have realized the cumbersome nature of the demotic cursive script and attempted to write their language in the very simple Greek characters. These attempts resulted in the development of the Coptic alphabet of 31 letters, of which 24 were borrowed from the Greek alphabet, while the remaining seven, representing sounds for which the Greek alphabet had no equivalent, were derived from demotic. In addition to its simplicity this alphabet has the great advantage of expressing the vowels as well as the consonants. As the vowels are never indicated in the older system, Coptic becomes practically the only guide to the vocalization of all the earlier stages of the language.

**Literature and Science.** That the literature of the ancient Egyptians was very rich is evident from the remains of it that we now possess. The earliest examples of religious literature are preserved in the texts engraved in the pyramids of dynasties Five and Six at Saqqara and consist of magical formulæ designed to secure the welfare of the deceased in the future life. They have been published and translated by Maspero in *Recueil de travaux* (Paris, 1882 et seq.). A later collection of texts of a similar character is to be found in the *Book of the Dead*. (See DEAD, BOOK OF THE.) The great mass of Egyptian religious literature consists of imitations of, and extracts from, these collections. There were, moreover, many religious myths, though but few have been preserved. Plutarch gives a very full account of the myths relating to Osiris and his family in his *Περὶ Ἰσίδος καὶ Ὀσίριδος*, and a few legends of the sun god Rê are to be found on the Egyptian monuments. These are fully treated by Wiedemann in his *Religion of the Ancient Egyptians* (Eng. trans., New York, 1897) and Budge,



*The Gods of the Egyptians* (London, 1904). There were also a number of ritual texts giving minute directions in regard to the temple services. The rituals of the Theban divinities Ammon and Mut have been published in facsimile by the authorities of the Berlin Museum (*Hieratische Papyrus aus dem Museum zu Berlin*, 1896-1901). Collections of moral maxims, resembling in many respects the biblical Book of Proverbs, seem to have been popular. Among the best known are the Proverbs of Ptah-hotep (Prisse d'Avennes, *Fac-similé d'un papyrus égyptien en caractères hiéroglyphiques, trouvé à Thèbes*, Paris, 1847) and the Prescriptions of Ani (Mariette, *Les papyrus égyptiens du musée de Boulaq*, Paris, 1872-77). All such works are, however, entirely without object and present no ideas. Egyptian science was also entirely practical and falls far short of the expectations raised by classical writers. The *Rhind Papyrus* of the British Museum, dating about 1600 B.C., is the most extensive mathematical work of the ancient Egyptians that has been preserved. Dr. August Eisenlohr published a facsimile of this papyrus, accompanied by a translation and commentary, under the title *Ein mathematisches Handbuch der alten Aegypter* (Leipzig, 1877), and a facsimile in colors was later issued by the trustees of the British Museum (London, 1898). Consult also Griffith, "The Rhind Mathematical Papyrus," *Proceedings of Society of Biblical Archaeology* (1891, 1894). It is a mere handbook containing the solution of a number of arithmetical and geometrical problems of practical application: How, e.g., to divide so many loaves of bread or so many jars of beer among a certain number of persons so that each shall receive a certain proportion; how to calculate the number of bushels of corn that can be contained in a granary of given dimensions; how to calculate the area of a field of given linear dimensions, etc. Notation for whole numbers was decimal, and all fractions except two-thirds were primary. Addition and subtraction were easily handled, but multiplication or division by any number larger than two involved a very long and tedious process. Of the astronomy of the Egyptians little is known at present, though it is evident that they paid much attention to the subject. They mapped out the constellations, distinguished between planets and fixed stars, and constructed charts exhibiting the positions of the stars during the 12 hours of the night. The Egyptian year contained 365 days divided into 12 months of 30 days each, with 5 intercalary days added at the end of the year. From the earliest times great attention was paid to medicine, and the Egyptian physicians enjoyed a high reputation among the nations of antiquity. One extensive medical work, the *Papyrus Ebers* (see EBERS, G. M.), written about 1550 B.C., has been preserved and fragments of similar works have been found. Among the latter are portions of treatises on gynecology and veterinary medicine. (Consult Griffith, *The Petrie Papyri*, London, 1898.) Although embalming was practiced from very early times, the Egyptians never acquired much knowledge of anatomy. Their medical works are little more than collections of prescriptions, and it is evident

that their practice was altogether empirical. The remedies prescribed are often most repulsive, and the repetition of magical formulæ was believed to increase the efficacy of the medicaments employed. The belief in magic was universal in all periods of Egyptian history, and the literature on the subject is most extensive. It has been seen that the magical formulæ of the *Book of the Dead* and of older collections of similar import formed the bulk of Egyptian religious literature, and, in addition to these collections, numberless charms and incantations were devised for every conceivable purpose. A most interesting collection of these incantatory formulæ is to be found in the well-known *Harris Magical Papyrus* (Chabas, *Le papyrus magique Harris*, Châlon-sur-Saône, 1860). No collection of laws has been found, though there are many documents illustrating the civil and criminal laws of the ancient Egyptians. Among the most interesting and valuable of these are the *Turin Papyrus* (trans. by Renouf in *Records of the Past*, 1st series, vol. viii, London, 1879), containing a report of the proceedings in regard to a conspiracy against Rameses III (see TURIN, PYPYRUS), and the *Abbot Papyrus* (trans. by Horrack, *Records of the Past*, 1st series, vol. xii), which contains a report of the investigation of the tomb robberies in the reign of Rameses IX (about 1100 B.C.). Full accounts of these celebrated cases are given in Erman, *Life in Ancient Egypt* (New York, 1894). The poetry of the Twelfth dynasty formed the model for all subsequent periods; it somewhat resembles Hebrew poetry, employing the same parallelistic form, but is much inferior to it. The only epic poem that has survived celebrates the victory of Rameses II over the Hittites at Kadesh on the Orontes. It contains some spirited passages, but the action drags interminably, and the long and turgid declamations in which the King boasts of his superhuman prowess, are wearisome to a modern reader. The authorship of the poem has been erroneously attributed to a certain Pentaur; he was, however, merely the copyist of the manuscript (*Papyrus Sallier*, iii), which is published in the *Select Papyri of the British Museum*, part i (London, 1842). A translation of the poem by Lushington is given in *Records of the Past*, 1st series, vol. ii (London, 1875). In lyric poetry the Egyptians were more successful. There are many fine hymns, and the few love songs that have survived are graceful and pleasing, though they exhibit no great depth of feeling. Good examples of the former are to be found in Wiedemann, *Religion of the Ancient Egyptians* (New York, 1897); the love songs are collected in Maspero, *Études égyptiennes* (Leipzig, 1879), and are more fully treated in W. Max Müller's *Die Liebespoesie der alten Aegypter* (Leipzig, 1899).

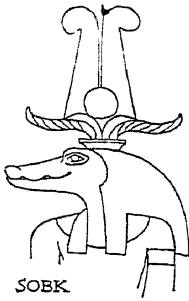
In their literature the Egyptians excelled all other Oriental nations of antiquity. While, however, it preserves various tales for us, it is lacking in much literary value. Its style is stilted and artificial and makes use of many repetitions. Its poetry lacks rhyme and, so far as our knowledge permits judgment, did not possess rhythm. From the earliest times they delighted in tales and stories, and the professional story teller was as familiar a figure in ancient Memphis and Thebes as he is to-day in the bazars of Cairo. Many of these old Egyptian tales have been preserved and are accessible to modern readers in excellent translations. It



is, of course, natural that such stories should attach themselves to famous historical personages of former days, and this is the case with the *Papyrus Westcar* (Erman, *Die Märchen des Papyrus Westcar*, Berlin, 1890), a collection of stories dating from the time of the Middle Empire. In this collection King Cheops is represented as suffering from insomnia and calling upon his sons to entertain him with stories. We here recognize the earliest example of the familiar literary device, often employed in later times, whereby a number of persons are brought together by some special occasion which furnishes a motive for story telling. The princes obey their father's command and narrate, in turn, tales of the wonders wrought by famous magicians. One of these magicians constructs a small crocodile of wax, which, when thrown into the water, attains a formidable size and seizes the lover of the magician's faithless wife. Another by his incantations lays bare the bed of a lake and recovers a jewel lost by a lady of the court, after which he returns the water to its former place. When the turn of Prince Hardadaf comes, he tells of a wonderful magician then living and is commanded to bring him to court. The magician, after giving some marvelous proofs of his skill, predicts that the wife of a certain priest will shortly bear to the sun god Rê three children, who will establish a new dynasty in Egypt. The narrative then passes to the birth of the children and the marvels by which it was attended. Unfortunately the manuscript is incomplete, and the end of the story is lost. The tale of the *Fated Prince* (*Papyrus Harris*, No. 500) is based upon a motive familiar in the folklore of many peoples. A prince is born, and at his birth it is predicted that he will die by a crocodile, a serpent, or a dog. To prevent the accomplishment of the prediction, his father causes him to be brought up in an inaccessible castle, where he is carefully watched and tended. Attaining manhood, the prince refuses to remain thus imprisoned and sets forth into the world to seek his fortune. He weds a princess whose watchfulness saves him from the serpent, and his faithful dog seems to be the means of his deliverance in his adventure with the crocodile. But here the manuscript breaks off, and we are left in doubt as to whether he succumbs to the third fate or is delivered from this also, perhaps by the interposition of some deity. The well-known *Tale of the Two Brothers* (*Orbiney Papyrus*) is fortunately preserved entire. In this tale two brothers live affectionately together until the wife of the elder falls in love with the younger and tempts him. He rejects her offer of love, and in revenge she falsely accuses him to her husband, who seeks to kill him. The younger brother flees from his home and takes up his abode in a solitary place. The gods, pitying his loneliness, fashion a woman of surpassing beauty to be his wife, but she, too, proves faithless. A lock of her beautiful hair is borne by the sea to the King of Egypt, who sends his messengers, and she readily allows herself to be carried off. Her husband is slain, but is miraculously restored to life and, after a series of wonderful adventures, becomes King of Egypt and punishes his faithless wife with death. In addition to the wonders of magic, travels and adventure in strange lands formed a favorite theme of the Egyptian story tellers. The story of the shipwrecked mariner, a sort of Egyptian

Sindbad, who is cast upon a fabulous island peopled with serpents, and the legend of the taking of Joppa by the General Tahuti, who contrives to introduce his men into the town concealed in sacks of grain, are good examples of this kind of narrative. In all these stories the style is simple and unaffected, and the interest lies entirely in the development of the plot. Of an entirely different type is *The Story of Sinuhe* (Lepsius, *Denkmäler*, vol. vi, Leipzig, 1858), an Egyptian of high rank, who flees his country on account of some political complication and takes refuge with the Syrian Bedouins. He is kindly received, vanquishes a redoubtable champion in single combat, and is advanced to high honor. But after a prosperous life among the Bedouins he yearns in his old age for his native land and applies to the Pharaoh for permission to return to Egypt. His request is granted, and on his return he is restored to all his former wealth and honors. In this story the plot is extremely simple, while the style is ornate and florid, and the narrative is loaded with rhetorical embellishments. Of a similar character is the story of the *Eloquent Peasant* (Lepsius, *Denkmäler*, vol. vi, Leipzig, 1858). The peasant is robbed of his ass and applies to the chief official of his district for redress. His eloquence excites the admiration of the official, who reports the matter to the King, and by his command the case is carried on from term to term, the peasant's speeches being carefully written down and reported to his Majesty. Here the very slender thread of narrative merely serves to carry the semipoetical speeches of the peasant, which, for the ancient reader, constituted the real charm of the book. It would seem that these very elaborate compositions were intended for a more cultured circle of readers, while the tales of magic and wonderful adventures reflect in their simple style the stories current among the people. The rhetorical narrative belongs, moreover, to a particular period, that of the Middle Empire. Although still cultivated to some extent by the learned, especially for educational purposes, it seems to have gone out of fashion under the New Empire, and thereafter Egyptian taste affected the simpler tales of magic and adventure. One of the latest romances that have been preserved is the tale of *Setna Kha-em-Wa'st* (Hess, *Der demotische Roman von Setna Kha-em-Wa'st*, Leipzig, 1888) found in a demotic papyrus of the Ptolemaic period. The hero, a son of King Rameses II, devotes himself to the study of magic and descends into an ancient tomb to obtain a wonderful book of enchantment written by the god Thoth himself. He secures the book, but its possession brings unhappiness, and he is at last compelled to restore it to its place and to make expiation for having removed it. The plot of this tale is well constructed, the action advances rapidly, and the incidents are varied and wonderful. But although it is in some respects a more elaborate composition than the tales of the older period, the style is simple and shows no trace of the straining after effect which characterizes the rhetorical narrative of the Middle Empire. Translations of such old Egyptian tales as have been preserved are given in Maspero, *Les contes populaires de l'Égypte ancienne* (Paris, 1889), and in Petrie, *Egyptian Tales* (London, 1895-99). The best translations from the various departments of Egyptian literature are to be found in *The World's Best Literature* (ed.

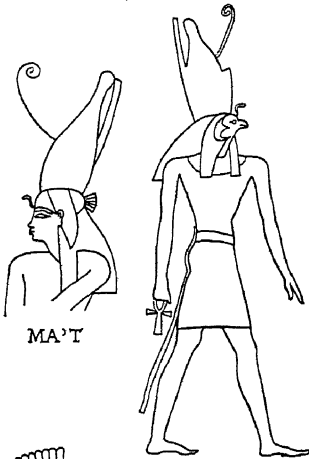
# EGYPTIAN DEITIES



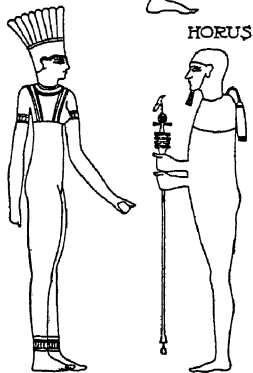
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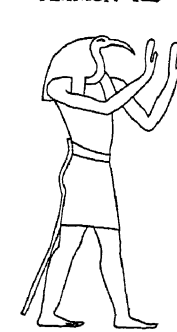
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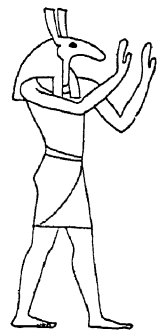
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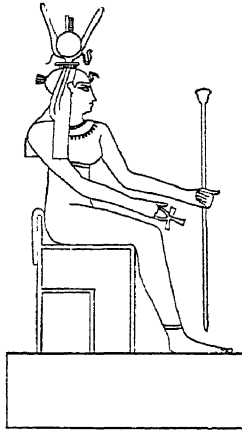
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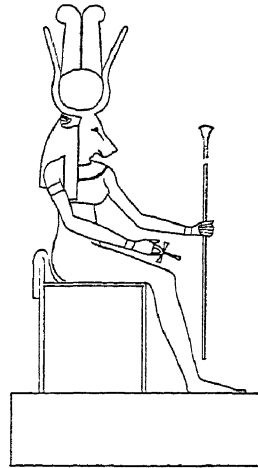
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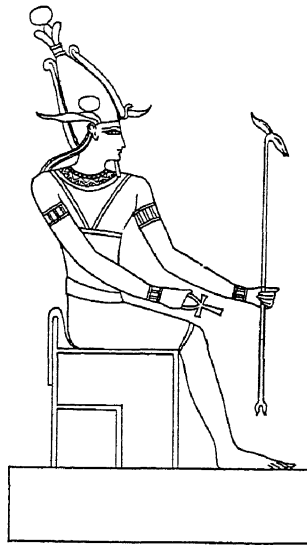
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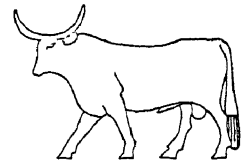
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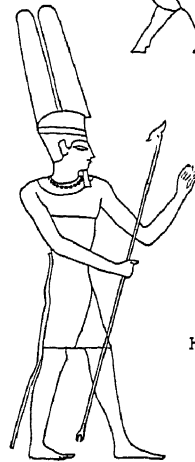
ATHOR



OSIRIS



APIS



AMMON-RÉ



HARPOCRATES



Warner, New York, 1897); the translations in the first series of *Records of the Past* (ed. Birch, London, 1874-79) are to be used with caution.

**Ancient Religion.** The religion of ancient Egypt had its origin in a low kind of fetishism, or animism, of purely African character. Every village of prehistoric times seems to have had its own god or demon, worshiped in some object, usually a tree or an animal. Out of this endless pantheon, in course of time, only the "great gods" survived, i.e., those of the principal cities. The most important deities of the . . . places were brought into relation . . . of a city by becoming his child, his wife, etc.; thus, most of the principal deities are surrounded each by his "circle of gods." The worship of the celestial bodies, principally of the sun, developed early, but was connected with the leading cults, so that the sun never had one name throughout all Egypt. The earliest forms seem to be *Ré* and *Horus*, whom the theologians differentiated as the midday sun and the young morning sun respectively (both worshiped in hawk form). In the earliest texts, however, we find *Heliopolis* in possession of its own sun god, *Atrau*, in whom the later theological system saw the old setting sun. *Osiris* (the local god of *Abydos* and *Busiris*) also became the setting sun, ruling the lower heavens. In short, sooner or later, almost every local divinity was treated as a form or phase of the sun. The confusion which existed even in the earliest religious documents cannot be described. The Egyptian priests, of course, felt this confusion, but their attempts to construct a logical system were of little avail. Their genealogies of the gods, their identification of all similar divinities, who were explained as different manifestations of the same deity, their division of the world and of the natural forces among the various gods of the pantheon, were contradictory and merely served to increase the confusion. *Amenophis IV* endeavored to carry the identification of the various divinities to its logical conclusion and to establish a species of monotheism, in which the sun was worshiped as the supreme source of life and power. But although *Amenophis* carried on his propaganda with fanatical violence, the attempted reform did not survive his own reign. The highest development of the later religion, springing from the identification of all divinities, led to pantheistic ideas after 600 B.C.; but these advanced thoughts did not touch the popular religion, which always remained attached to the old fetishistic local cults, to the worship of animals, etc.—to those features, in fact, which were so unintelligible to the Greeks that they sought to explain them as veiling higher ideas under a mysterious symbolism. The ibis *Thoth* (*Dhouti*) of *Hermopolis* became a moon god and the father of science and letters, like the Greek *Hermes*, whom he also resembled in his function as leader of the dead. *Ptah* of *Memphis* was one of the creators of the world, being a craftsman and artist (like *Hephaestus*). The cow-formed *Athor* of *Denderah* eventually became the goddess of love. *Ammon* of *Thebes*, after 1600 B.C. the chief god of Egypt, is, of course, a sun god; his wife *Mut* becomes the sky, and their child *Khonsu* the moon. At *Eileithyia* was revered the goddess *Nekhbet*, whose counterpart for Lower Egypt is *Buto*; at *Bubastus*, the cat *Ugabstet* was worshiped; at *Sais*, the Libyan goddess *Neit*; in the Fayum, the crocodile *Sokk* (*Souchos*). The ithyphallic

harvest god *Min* was worshiped at *Chemmis* and *Coptos*; at *Elephantine*, the ram *Khnumu* (*Cinuphis*) and the goddesses *Anuket* and *Satet*. Under the New Empire many Semitic gods were introduced and became very popular: *Baal*, *Astarte*, *Anat*, *Kadesh*, *Rashpu* (lightning), etc. The cult of some gods can no longer be localized; e.g., that of the beetle *Khepre*, another creator of the world and sun god; that of the good dwarf *Bes*, the patron of the dance, of music, and of female dress; that of the equally benignant female hippopotamus *Tuêris*, etc. The principal animals worshiped as gods were the bulls *Apis* at *Memphis*, *Mnévis* at *Heliopolis*, and *Bachis* at *Hermonthis*, the goat at *Mendes*, etc. These were all incarnations of local gods. Different is the general sacredness of an animal from a divinity; thus at one place all cats were sacred, at another all dogs. It occasionally happened that in one locality an animal was proscribed and persecuted, while in the neighboring town it was held sacred, as, e.g., at *Bahnasa* (q.v.).

Egyptian mythology seems to have been very rich; legends of the gods were attached to every sanctuary, and dramatic representations of them, in which priests played the part of gods, were given at the local festivals. Allusions to these myths abound in the religious texts, but details are rarely given, and, of all the great mass of Egyptian . . . lore, only the myths relating to . . . family and a few legends of the sun god *Ré* have survived. *Osiris*, originally the local god of *Abydos* and *Busiris*, was one of the many deities who in course of time acquired a solar character. He was especially identified with the setting sun, ruling the lower heavens and the mysterious region below the western horizon. He thus came to be regarded as the god of the realms of the dead, and his worship became popular throughout the land. In Egyptian mythology *Osiris* was the beneficent ruler of mankind; who elevated his subjects from barbarism and taught them the arts of civilization. He, however, incurred the enmity of his wicked brother *Set*, by whom he was treacherously murdered. His body, inclosed in a chest, was cast into the Nile and floated out to sea. *Isis*, the sister and wife of *Osiris*, after a long search found her husband's body and buried it; but it was disinterred by *Set*, who cut it in pieces and scattered the fragments far and wide. *Isis* searched out all the pieces and buried them separately. In the meantime *Horus*, the young son of *Osiris* and *Isis*, grew to manhood and avenged his father by defeating his murderer in a terrific combat. *Osiris*, though dead on earth, lived in the under world and became the ruler of the dead. His sister and wife *Isis* may be identified with the constellation *Virgo*, and their child *Horus* is the young morning sun. *Osiris* has another sister, *Nephthys*, who is married to his brother and murderer *Set* (*Typhon*). The jackal *Anubis* (q.v.), the guardian of the lower world and the patron of embalmers, is the son of *Osiris* and *Nephthys*. *Set* may have been originally the constellation *Ursa Major*; he then became the personification of every force of nature opposed to the sun, the prime mover of all disorder and violence. He thus came to be a god of war and, after 1000 B.C., a sort of Satan. Every evening he cuts *Osiris* in pieces (the stars), which *Isis* unites every morning. The parents of the hostile gods are *Seb* (or *Gêb*) and *Nut*—earth and

heaven. The parents of these are Shu (Shou) and Tefnut (perhaps ether and moist air), while the father of all the gods is Nuu (later erroneous form, Nun), the primeval abyss. The Osirian myth is very fully treated by Plutarch in his *Περὶ Ἰσιδος καὶ Ὀσίριδος*, and the general accuracy of Plutarch's account is attested by numerous allusions in the Egyptian texts. The legends of the sun god Rê are derived from monumental sources. According to these legends Rê appeared in primeval ages, and after defeating the powers of darkness assumed the government of the world. He reigned long and peacefully, but finally grew old, and his powers failed. The wise goddess Isis took advantage of his weakness to gain a long-cherished wish. She was deeply versed in magic and in all hidden and mysterious knowledge, but one thing was wanting—she did not know the secret name of Rê, upon which his power was founded. In order to learn the secret she had recourse to a stratagem. Taking some of the god's saliva, she kneaded it with earth and formed a poisonous serpent, which she placed in the path along which Rê was wont to walk. As the god took the air with his attendants, the serpent stung him, and the poison caused him intense pain. He called upon all the gods for aid, but none could relieve him save Isis, and she would heal him only at the price of his secret name. For a long time Rê held out, but finally, no longer able to endure the torment, he revealed the secret and regained his health through the magic powers of Isis. His vigor was, however, impaired, and even men dared to rebel against him. In his anger he called a council of the gods, in which it was decided to send the goddess Athor to destroy all mankind. In the night Athor descended to the earth and began such a fearful slaughter that blood ran in rivers, and even the gods were appalled. Rê determined to stop the massacre. He caused beer to be prepared and had it poured out at evening so that it overflowed the fields. In the morning the goddess, drinking copiously of the beer, became drunk and was unable to recognize mankind. Rê was now weary of rule, and he retired to rest in heaven, leaving the god Thoth as his deputy upon earth. Consult, in regard to Egyptian mythology, Wiedemann, *Religion of the Ancient Egyptians* (Eng. trans., New York, 1897), and Erman, *Life in Ancient Egypt* (Eng. trans., London, 1894).

It was at all times a deeply rooted belief of the ancient Egyptians that man possessed a spiritual part which continued to exist after death, although the precise nature of this existence was never very clearly defined. They regarded the human personality as consisting of at least three parts: the mortal, corruptible body (*khat*); the living soul (*ba*); and a sort of spiritual double, or ghost, which was called the *ka*. The *ba*, or soul, seems to have represented the vital principle; but it had other functions which are by no means clear. After death it was supposed to leave the body in the form of a bird, usually represented with human head and hands, and to fly up to the gods in heaven. The *ka* was an independent spiritual being, living within a man and representing his human personality both during life and after death. It was his inseparable companion during life, and after death it hovered around his mortal remains. At times it could enter and reanimate the body; it was necessary, therefore,

to preserve the body in such condition as to be always tenable by its spiritual visitor. To this end it was incumbent upon the relatives of the deceased to have his body as carefully embalmed as their means would allow and to place it in a tomb where it would find protection from all accidents. But although separated from the body, the *ka* still experienced hunger and thirst and other human needs. It was therefore necessary to provide food and drink, *boo*, . . . and such household effects as would . . . comfort of the *ka* in the tomb. It was not absolutely required that material food and drink should be supplied. Magical formulæ recited over the body or inscribed upon the tomb insured to the deceased the enjoyment of "thousands of bread, beer, oxen, and geese." Such formulæ were always repeated at the funeral by the reciter priest, and the inscriptions constantly adjure visitors to the tomb to repeat these important words.

The *ba* and the *ka* existed in the individual during life and continued to live as separate entities after death. But when life departed from the body, the spiritual personality of the deceased assumed a new form, known as his Osiris. Of what elements this spiritual counterpart of the deceased was made up is not explained, and the Egyptians themselves seem to have had very vague and confused notions upon the subject. So much, at any rate, is clear, that just as Osiris died and lived again, so the spiritual personality of the deceased lived again and was merged in Osiris, or rather it became Osiris himself. As to where and how the individual lived after death, various ideas were entertained. He was supposed to find a home among the stars, to sit like a bird on the branches of trees, to hover around his mummy in the tomb, or to appear upon earth in various transformations. According to the most widely prevalent belief, however, the defunct was conducted by the god Anubis to the realm of the dead, where he had to undergo judgment before Osiris, the King of the Lower World, and 42 Assessors, of strange and monstrous form. The path was beset with difficulties and dangerous gates had to be passed which opened only to those who knew the proper password; demons lay in wait to seize upon unwary souls; lakes of fire must be traversed; and many other obstacles lay in the way. But if the deceased were provided with the appropriate formulæ of the *Book of the Dead*, he surmounted all these difficulties and finally entered the judgment hall. If the judgment was adverse, he was cast into a fiery lake, or given over to be devoured by a hideous monster. If, however, the judgment was favorable, the defunct was assigned an abode in the Elysian Fields and enjoyed a perpetual banquet at the table of Osiris. If, moreover, he knew the proper magical formulæ, he could come forth upon earth and assume any shape he pleased; he traversed the heavens in the boat of Rê and Horus and shared in their triumph over the powers of darkness; all earthly impurities were washed away, the divine portion alone remained, and he became a god. In the course of the final judgment the deceased was obliged to present himself before each of the 42 judges in turn and declare himself free from a particular sin. This constituted the celebrated "Negative Confession," which is to be found in chapter *ccxv* of the *Book of the Dead*. It indicates the existence of a high standard of morality and is

thoroughly in accord with the teaching of the moral papyri and with many funerary inscriptions in which the particular virtues of the deceased are detailed. It was not, however, necessary that the deceased should be actually guiltless of all the sins; it was only necessary that he should declare himself guiltless of them, and, above all, that he should know the names of the infernal judges. If he knew the proper chapter of the *Book of the Dead*, or even if it were written out and placed in his coffin, he had nothing to fear.

It is sometimes assumed that the Egyptians looked for a general resurrection of the dead and for a great day . . . when all mankind must answer . . . the deeds done in the flesh. Of this, however, the evidence is far from satisfactory, and it would rather seem that each individual underwent judgment and received his reward or punishment shortly after death. Consult: Wiedemann, *The Ancient Egyptian Doctrine of Immortality* (New York, 1895); Erman, *Life in Ancient Egypt* (London, 1894); Bridge, *The Gods of the Egyptians* (ib., 1904); Steindorff, *Religion of the Ancient Egyptians* (New York, 1905); Wiedemann, *Religion of the Ancient Egyptians* (ib., 1897); Maspero, *Études de mythologie et d'archéologie égyptienne* (Paris, 1893). Brugsch, *Religion und Mythologie* (Leipzig, 1884-88), is full, but not critical. For illustrations, consult Lanzzone, *Dizionario di mitologia egizia* (Turin, 1881-88). Champollion, *Panthéon égyptien* (Paris, 1825), is useful.

**Manners and Customs.** The wonderful fertility of the Nile valley has been famous in all ages, and under normal conditions the produce of the soil has always sufficed to support a dense population and to leave a large surplus of commodities for export. Agriculture was the source of Egypt's wealth and probably the most important factor in the development of her civilization. Under these circumstances it was natural that social conditions were largely determined by the ownership of land. In the time of the Old and Middle empires the land was, with exception of the crown domains, in the hands of a limited number of noble families. Neither at this time nor at any subsequent period is there any trace of a free peasantry. Through all ancient Egyptian history the agricultural laborer was a serf, and the condition of his modern representative, the Egyptian fellah, is hardly better.

The monuments of the older period, erected without exception by wealthy nobles, have little to say in regard to the existence of a middle class; but that such a class existed can hardly be doubted. The splendid creations of the art and architecture of the Fourth and Fifth dynasties postulate the existence of a class of artists and artisans who could plan and carry out such works. While textile fabrics might be produced by the peasant women on large estates, other manufactures required the existence of a manufacturing class. And finally, in the cities at least, there must have been merchants who handled the produce of the soil and articles of necessity and of luxury. Under the New Empire the agrarian conditions were very different. The old noble families were exterminated or impoverished in the Hyksos wars, their lands came into the possession of the crown, and large estates eventually fell to the share of the temples. The agricultural serfs merely changed masters and

were oppressed pretty much as before; but the new conditions favored the rise of the middle class, who now came into much greater prominence and even held important offices in the government and in the hierarchy. The Greek accounts of the division of the people into priests, warriors, and several other classes, each containing a number of subdivisions, must not be taken too literally and are far from proving that castes like those in India existed. It seems to be true that all occupations were highly specialized and thus divided into a number of branches; it is also true that Egyptian conservatism very frequently caused a son to adopt his father's occupation. But there was never any restriction in regard to the choice of an occupation or against the intermarriage of classes, except in so far as such matters were affected by those social prejudices which have existed at all times among all peoples.

At the head of the whole social organization stood, of course, the King, who was not merely the supreme ruler, but the direct descendant of the sun god Rê and therefore entitled to divine honors. After his death he was worshiped as a god. His principal wife, the Queen, was of royal birth or descent and not infrequently the sister of her husband. Such a marriage was regarded by the Egyptians as highly . . . since the issue inherited a double . . . divine blood of Rê. The Queen shared in all the honors of her husband and, if she survived him, still possessed high influence at court, especially if she were the mother of his successor. From motives of policy Egyptian kings often married foreign princesses; but these ladies never stood upon the same footing as the Queen; they were all subordinate wives, but one step higher than the other ladies of the harem. In the time of the . . . dynasty an Asiatic prince sent, as a . . . harem of Amenophis III, his eldest daughter, accompanied by 317 beautiful damsels. It is therefore not surprising that the Egyptian kings should have a large posterity. Rameses II is said to have had 200 children, and of these, 111 sons and 59 daughters are mentioned in the inscriptions of their father. At the court great state and ceremony were maintained, and when the King appeared in public on ceremonial occasions he was attended by an army of courtiers, priests, bearers of the royal insignia, fan bearers, officers of the household, and many other officials of various grades.

Under the Old and Middle empires the wealth and power were in the hands of the nobles. The heads of the great families were the nomarchs, who possessed large landed estates and, with their relatives, filled all the higher offices of court and state. In the time of the Fourth and Fifth dynasties the monarchs seem to have preferred the neighborhood of the court; but under the feudal system of the Middle Empire they usually resided on their estates, where they lived in princely style. In addition to his private property the ruling nomarch enjoyed the revenue of the "house of the prince," which means the emoluments attached to his office arising from certain taxes and other sources of income. He was also, by right of birth, a member of the priestly college of the local temple and was usually its head. Under the New Empire, though most of the old titles were retained, the offices were chiefly filled by priests and military officers. The nomarchs were no longer feudal princes, but government officials who

could be appointed or removed at the pleasure of the King or his advisers.

Before the time of the New Empire most of the nobles and high officers of state bore priestly titles and exercised priestly functions. They monopolized, in fact, all the high offices of the priesthood, although it is probable that in most cases their duties were light and that they were only required to officiate upon certain stated occasions. The regular religious services were carried on by lower orders of priests, whose emoluments were not large and who seem to have occupied rather a subordinate position in the social organization. In addition, there were brotherhoods of so-called "hour priests," composed of pious laymen, each of whom devoted a portion of his time to the temple service, while the whole body took part on certain special occasions. These brotherhoods disappear under the Middle Empire.

The great wealth lavished upon the temples by the monarchs of the Eighteenth and subsequent dynasties brought about a very different state of affairs. The temples became great corporations, possessing immense wealth and large landed estates administered by their own officials and worked by their own serfs. The power wielded by the heads of these religious houses was very great, and the position of the whole priesthood was elevated in a marked degree. Apart from the material influence given them by their wealth and political power, the priests were the exclusive custodians of the higher learning and exercised a profound influence upon the minds of the superstitious Egyptians, by whom they were credited with the possession of magical power. The priests were divided into a number of classes, according to their several functions; all classes were bound to observe scrupulous personal cleanliness, and in token of this they wore pure white linen garments and shaved their heads.

Until the New Empire there was no distinct military class. Each nome had its own militia, and the nomarch was bound to furnish a certain contingent in time of war. But the Egyptians were never a warlike people, and hence from the earliest times they depended largely upon foreign mercenaries—at first Nubians, later Libyans and Europeans. Under the New Empire the army was of vastly greater importance; some of the highest offices of the state were held by military men, and the army vied with the priesthood in political influence. At a later period in military families, who were generally of foreign origin, the connection with the army was commonly inherited, together with the field given by the government as a fief for service. See paragraph on the Egyptian army under the title ARMIES.

The chief occupation of the Egyptians has always been agriculture. Wheat, barley, and durra (black millet) were the staple crops; but vegetables and fruits, such as onions, cucumbers, melons, grapes, and figs, were also extensively cultivated. The methods employed were rather crude. The soil was broken with a wooden plow drawn by oxen and was laboriously worked with a heavy wooden hoe. After the seed was scattered, flocks of sheep were driven over the freshly sown field to trample down the soil. At the time of harvest durra was pulled up by the roots, but other grain was cut with a short sickle. On the threshing floor the grain was trodden out by

the hoofs of animals; under the Old Empire these were usually donkeys, while in the time of the New Empire oxen were used for this purpose. After threshing, the grain was passed through a coarse sieve and was then winnowed by tossing it in the air with small wooden hand shovels. It was then measured by the scribes and stored in the granaries. Cattle raising was extensively carried on from very early times. Under the Old Empire there were still many marshy tracts in Upper Egypt which furnished excellent pasture and at all times the Delta was a fertile plain ground. Much attention was paid to the improvement of the stock, and the finest bulls were always reserved for breeding purposes. Goats and sheep were raised in great numbers. The donkey was the ordinary beast of burden, although oxen were also used. Horses are first represented on the monuments of the Eighteenth dynasty; they were usually harnessed to chariots for war or for traveling, but were rarely ridden. Stallions were preferred to mares, and geldings do not seem to have been used until a very late period. Camels are not represented on the monuments before the time of the Ptolemies.

The Nile was the great highway of travel and traffic and with its numerous canals gave easy access to all parts of the country. Timber was scarce, and the smallest boats were flat-bottomed skiffs constructed of bundles of papyrus reeds bound tightly together; they were propelled by poles or paddles, according to the depth of the water. Larger vessels were built of wood obtained from Nubia. These were also flat-bottomed and had the characteristic form of the modern Nile boat, in which the stern has considerably more overhang than the bow, so that, should the vessel run on a sandbar, the bow could be lifted off by throwing the weight astern. These boats varied considerably, according to the use for which they were intended. Freight vessels were broad and clumsy, resembling scows. War vessels and boats intended for travel and recreation were often handsomely decorated. In addition to the oars, they were usually provided with a large square sail attached to a yard. It was not until the time of the New Empire that a second yard, at the foot of the sail, was added. Both yards had braces and sheets for trimming the sail. The sheets, halliards, and standing rigging were all made fast inside of the gunwale. War vessels sometimes had a crow's-nest at the top of the mast, for a lookout or for archers. Large steering oars supplied the place of the rudder. But though they were at home in river navigation, the Egyptians were always disinclined to maritime enterprises, and therefore the carrying-trade of the Mediterranean remained in the hands of the Phœnicians, while the infrequent expeditions of Egyptian ships down the Red Sea to the Somali coast (see PUNT) did not result in the establishment of extensive traffic in that direction. In the south a very important trade was carried on with Nubia, and trading posts were early established at Syene and Elephantine (q.v.), where panther skins, ebony, ivory, and ostrich feathers were bartered for Egyptian commodities. To the north a considerable trade was carried on by caravans with Syria and other Asiatic countries. While there is little to tell us how trade was transacted, commerce was probably conducted by barter, and in the early period money of any sort seems to have been unknown. Under the



New Empire metal rings were used as currency, a copper wire of given weight serving as unit. Although Egypt was chiefly an agricultural country, her manufactures were important and were early developed. Linen was extensively manufactured, and the finer grades of the ancient Egyptian linen cannot be surpassed in modern times. The papyrus plant furnished material for several industries. Bundles of papyrus reeds took the place of wood for the construction of small boats, and from the twisted fibres sandals, ropes, mats, sails, fishing nets, and other objects were made. The most important use of the plant was, however, in the manufacture of paper. For this purpose the stalks were cut into thin strips, and a layer of these strips was placed upon a flat surface. Over this a second layer was placed at right angles to the first layer. The leaf thus formed was pressed out into a thin sheet, to which the natural gum of the plant gave a homogeneous character. The sheets were then dried and were ready for use.

In the working of leather the Egyptians were very skillful. The coarser leather was used for the soles of sandals and shoes; from the finer grades were made aprons, belts, coverings for chairs and sofas, harness, chariot trappings, bow cases, and many other objects. Fine colored leather was stamped with ornamental patterns.

Clay is to be found in all parts of Egypt, and the potter's art was very early developed. The Egyptian earthenware was made upon the potter's wheel and was usually of a very simple character. For ornamental purposes, however, the Egyptians knew how to prepare a glazed ware resembling faience, and of this they made statuettes, vases, beads, and other small objects. Glass was produced at a very early period, and glass blowing is represented in pictures of the Middle and New empires. The Egyptian artisans were proficient in metal working, although metals had to be imported and were therefore scarce. Tools and weapons of the earliest period were made of copper, later of bronze. Iron, although known from very ancient times, was always scarce and was therefore not extensively used. Silver was in earlier times more valuable than gold; but under the New Empire it became more plentiful, and the relative values of the precious metals were reversed. An amalgam, corresponding to the *electron* of the Greeks, and containing two parts of gold to three of silver, was much used for jewelry and ornamental purposes. The great skill of the Egyptian goldsmiths and jewelers is exhibited in many specimens of their art that have been found in the tombs. They were adepts in the use of enamels, which were beautifully colored, and they made skillful imitations of precious stones in paste.

For building purposes and for sculpture the Egyptian quarries furnished an ample supply of stone of various kinds. From the quarries of Turah, nearly opposite Memphis, came the fine white limestone, which was used for mastabas, pyramids, and statues, and alabaster was obtained in the same neighborhood. Sandstone was obtained from the quarries near Gebel Silsileh, and near Assuan was quarried the beautiful red granite used for obelisks, columns, statues, and doorways, and for other architectural and artistic purposes. In the Wadi Hammamat was quarried the black granite used for statues and sarcophagi. Although working with inferior tools, the Egyptian artisans

handled the hardest stones in a manner unsurpassed in modern times. Their cutting was done with a small metal chisel and a wooden mallet, and they obtained a fine polish by rubbing with pieces of quartz or with quartz dust.

As a building material, stone was chiefly used for the construction of temples, tombs, pyramids, obelisks, and other enduring monuments; private houses were built of bricks made of Nile mud. The dwellings of the poorer class were generally mere hovels; those of the wealthy were often of considerable size and contained many rooms. The framework was of timber, and at the entrance there was often a columned portico. In some examples represented on the monuments the roof is raised above the upper story by small pillars, and the spaces between the pillars are left open to secure free ventilation. In others an awning is stretched over the flat roof, which was apparently the favorite resort of the family. Country houses were surrounded by gardens with beds of flowers, alleys of trees, and artificial lakes.

The Egyptians were not a grave and philosophical people; on the contrary, they were gay and cheerful. They were fond of amusement, and their frequent social entertainments were enlivened by the performances of musicians, dancers, and jugglers. Women as well as men were guests at these feasts, which were not always of a very sober character. As a people, the Egyptians were much addicted to the use of intoxicating beverages. Beer was the national drink; it was brewed from barley malt, and several kinds of beer are mentioned in the inscriptions. Wine also was largely consumed, and the Egyptian vineyards produced both red and white wines in abundance.

Of the many games mentioned or depicted on the monuments, the game of draughts appears to have been most popular. It was believed to form the favorite recreation of the blessed dead in the Lower World, and many draught boards have been found in the tombs.

At all times the Egyptians took great delight in field sports. The marshes were well stocked with aquatic birds, which the sportsman, pushing among the reeds in his skiff, brought down with a throw stick. Angling with rod and line and the spearing of fish were also favorite amusements. Larger game, especially the antelope, was hunted with hounds in the Libyan Desert, and lions were often killed in the same locality. At the popular festivals a favorite sport was the water tournament, in which the contending boatmen stood in their skiffs and sought to push their opponents overboard with long poles. Wrestling and cudgel play were also features of these occasions, and such contests were often so earnest that the defeated contestant had to be carried from the field.

In ancient Egypt women enjoyed a much greater degree of independence than in other countries of antiquity. They appeared with their husbands at social entertainments and took part in religious ceremonies. There were regular orders of priestesses attached to the service of the gods, and under the New Empire the priestesses, or "singers," of Ammon of Thebes were a very important body. At the head usually stood the Queen, and the lower grades were composed of the wives and daughters of priests, officials, military officers, and even artisans. The Egyptian laws secured to women the full enjoyment of the rights of prop-

erty. A married woman, e.g., could hold property at her own separate disposal and could even lend money on interest to her husband. Polygamy was allowed, but was rarely practiced; as a rule, there was but one legitimate wife, who held a most honorable position in the household and had the direction of domestic affairs. A man might also have as many concubines as his means would allow, but extensive harems were a luxury of the rich. The Egyptians usually married young, and their large families were a source of wonder to the Greeks.

Although the higher learning was in the hands of the priests, education was rather widely diffused, and reading and writing were common accomplishments, even among the lower classes. Schools existed throughout the country; they were usually attached to the various governmental departments, and, under the New Empire at least, graduation in these schools opened the way to admission into the civil and military service of the state. The school discipline was severe, and the rod was freely administered. "The ears of the young," says the Egyptian proverb, "are placed on the back, and the boy hears when he is flogged." At first the young pupil was taught to form the characters on potsherds, papyrus being too expensive for this purpose. When he acquired some skill in writing he was set to copying moral maxims like our old-time copy-book texts, and as he advanced he copied longer extracts and finally complete texts which were selected for their matter and style. The moral papyri containing rules of conduct and of manners were commonly used for this purpose; but poems, tales, and religious texts were also assigned. In this way the student, as he gained skill with his pen, became acquainted with the best works of the national literature. Much attention was given to the formation of a good epistolary style, and to this end students were required to copy out collections of model letters upon various subjects. Arithmetic and bookkeeping were important branches of study, and under the New Empire instruction in these subjects seems to have been given. Throughout the course the pupil was carefully trained in ethics, in the practical philosophy of everyday life, and in good manners. The more advanced instruction was, of course, adapted to the career in life which the particular student expected to follow; but little is known as to the manner in which it was imparted.

In the care bestowed upon the dead the Egyptians surpass all other peoples of ancient or modern times. The means adopted were more or less elaborate in proportion to the wealth of the deceased's family, but the principle was the same in all cases. The body was first embalmed (see EMBALMING) and, after being swathed in linen bandages, was placed in the coffin. In the time of the Middle Empire magical texts (see DEAD, BOOK OF THE) designed to protect the deceased from the perils of the Lower World were inscribed upon the coffin boards. Under the New Empire similar texts were written upon papyrus and placed within the coffin. Amulets of various kinds were placed beside the mummy or hung about its neck. When these preparations were complete, the body was carried to the tomb, accompanied by relatives, friends, and troops of hired mourners. All the Egyptian cemeteries lay upon the west side of

the Nile, and hence it was frequently necessary to cross the river. When this was the case, the coffin was embarked upon a richly adorned barge, and the funeral cortège followed in other boats. From the time of the Old Empire the sacred soil of Abydos was a favorite burial place, and bodies were brought thither for sepulture from all parts of Egypt. At the place of burial the officiating priests performed the appropriate ceremonies; extracts from the sacred books were read, incense was burned, offerings were made, and the body was then committed to the tomb. Every provision was made for the comfort of the deceased. Alabaster figures of fowls, and loaves of bread, and little wooden wine jars, were provided, which, by virtue of the charms repeated over them, acquired the properties of real food and drink. In the same way the food was supposed to be prepared in wooden models of kitchens by statuettes of cooks and bakers. Should the deceased wish for recreation, there were games of various kinds and his favorite papyri. Did he desire to travel, he might voyage in wooden models of boats which, with oars, rigging, and crew, were placed in the tomb. He was, moreover, spared the necessity of performing labor in the future life by numbers of statuettes called *ushabtiu*, or "answerers," which answered to his name and took his place whenever any work was assigned to him. The tombs of the Egyptians varied with the period and with the means of the deceased and his family. Under the Old Empire wealthy nobles built the so-called mastaba tombs, flat oblong structures of stone, which surround the pyramids of the kings of the Fourth and Fifth dynasties. From the end of the Old Empire grotto tombs, hewn out of the solid rock, were preferred. Such tombs contained several chambers, and their walls were usually adorned with sculptures and paintings. To each tomb was attached a funerary chapel, where offerings were made from time to time. Tombs of this kind were, of course, only within the reach of great nobles and wealthy officials. For persons of moderate means a common type of tomb, under the Middle and New empires, consisted of a small pyramid of brick standing upon a low square base and having a little portico in front to represent the funerary chapel. The great majority of the people were, however, buried in the ground, and the site of the grave was usually marked by a stele, on which was carved a representation of the deceased standing before a table of offerings in the presence of Osiris and other gods. The poor were buried in shallow graves, without a coffin and with no stele to mark the spot; but the small alabaster bowls and the bones of animals found in these graves show that even here the welfare of the deceased had not been neglected. Consult: Breasted, *A History of Egypt* (New York, 1905); Erman, *Life in Ancient Egypt* (London, 1894); Wiedemann, *Alt-Aegypten* (Stuttgart, 1891) and *Aegyptische Geschichte* (Leipzig, 1884-88); Duemichen and Meyer, *Geschichte des alten Aegyptens* (Berlin, 1878-87). Wilkinson, *The Manners and Customs of the Ancient Egyptians* (ed. Birch, London, 1878), is antiquated, but is full of valuable illustrations.

#### HISTORY

**Ancient History.** All historical books written in hieroglyphics have been lost. Their ex-

istence is proved only by fragments of a short extract (a list of kings) on papyrus, preserved in Turin. (See TURIN PAPYRUS.) Manetho, a priest of Sebennytus, under Ptolemy Philadelphus, wrote an Egyptian history in three books, which has also been lost. Epitomes of it are preserved in the works of Josephus, Julius Africanus, Eusebius, and George Syncellus; but they are inconsistent and probably unreliable. Some historical material is found in Herodotus, Diodorus, and Eratosthenes, but it is intermingled with many errors. We are therefore compelled to rely chiefly on the inscriptions, which do not always supply adequate information. The greatest difficulty is in the matter of chronology. The Egyptians themselves had no fixed era, but dated by the regnal years of the respective kings, and the inscriptions alone do not always furnish a reliable connection between reigns. In the scanty extracts from Manetho's history the figures have been largely corrupted. Therefore the different systems of modern scholars lack uniformity. For example, the dates assigned to the first historical reign, that of King Menes, vary as follows: 5702 (Boekh); 5613 (Unger); 5004 (Mariette); 4400 (Brugsch); 3892 (Lepsius); 3623 (Bunsen); 3400 (Breasted); 2000 B.C. (Sharpe); etc. At the present day scholars content themselves with fixing approximate or "minimal dates," showing before what year a king must have reigned, though he may have lived 100 or even 1000 years earlier. Up to the present time no date before the eighth century B.C. has been fixed with certainty, and a fairly close approximation is possible only up to about 1600 B.C. Manetho's division of all the rulers of Egypt from the earliest period down to 342 B.C. into 30 dynasties or groups (not strictly families) has been, in general, confirmed. Dynasties One to Six are called the Old Empire; Eleven to Fourteen, the Middle Empire; with dynasty Eighteen the New Empire begins.

Egypt was apparently a civilized state at as early a date as was Babylonia. The possibility cannot be denied that Egyptian civilization may have been derived from that ancient centre of culture, but the evidence is not sufficient to decide the question. At any rate, long before 3000 B.C., Egypt possessed an independent culture, at least as high as that of Babylonia. The earliest history is obscured. The later priests filled many thousands of years with the mythical reigns of the different gods, after which they placed 4000 or more years of the demigods, or *manes*, i.e., prehistoric kings, whose names had been lost. The Egyptians considered Menes, or *Meni*, from This as the first remarkable historical King. We now possess many objects which seem to date from his time, found chiefly in the two great royal tombs at Nagada and at Abydos, and possibly relics of a few earlier kings, who even at that time ruled over all Egypt. The time when Egypt was divided into two kingdoms, the Delta and the Southern Land, has not yet been traced by archaeology, although in the royal titles the remembrance of that prehistoric division of the "two countries" was preserved even down to Roman times. The large tombs of the kings of dynasties One and Two were situated near Abydos and This (whence Manetho calls them Thinitic kings); these tombs were examined imperfectly by Amélineau in 1896, and afterward

thoroughly by Petrie. (Consult his *Royal Tombs*, London, 1900 et seq.) Thus we can go back to the middle of the fourth millennium B.C. or earlier. Of dynasty Three we know little more than the names of the principal kings. They resided near Memphis, and their tombs gradually assumed the later, pyramidal form. The earliest example, the step pyramid near Saqqara, is the work of Zoser, the fifth King of this dynasty. Under him we find the copper mines near Mount Sinai already being worked by the Egyptians.

Dynasty Four has left a great mass of monuments. The first King, Snefru, was the first great warrior. He made expeditions into Nubia and Syria and opened a new copper mine at Wadi Maghar. His two successors, the Cheops (q.v.) and Cnephren (q.v.) of Herodotus, built the two largest pyramids—works which were never equaled at any later period. Later tradition ascribes the famous Sphinx near the pyramids to Chephren, but this is doubtful. Menkaure, or Mycerinus, built the third in size of the great pyramids; all subsequent royal pyramids are considerably smaller. Under this and the following dynasty Egyptian sculpture reached its acme of perfection (c.2800 B.C.). The most remarkable monument of dynasty Five (12 kings) is the sun temple near Riga, of which a building in the form of an obelisk has remained. The last King, called Onnos by Manetho, inaugurated the custom of placing the chamber of the pyramid with the king's name. This example, followed regularly in dynasty Six, has furnished to us the extensive texts of the pyramids opened in 1880 (those of Teti or Atoti, Pepi or Apopi I, Merenrê, Pepi II, and Neferkarê) (Breasted, *Ancient Records of Egypt*, Chicago, 1907). These are all magical texts, of no historic but of great religious interest, being copies of books so old that they were partially unintelligible even to the scribes of that age. Pepi I (or perhaps Apopi—the vowels are not expressed) left numerous traces of his building activity; he also waged a great war in Palestine, for which he used many negro troops from the tributary regions of Nubia. Most of the kings of this period built their residences—every king building a new city—around Memphis; the city of Memphis itself derived its name (*Mennofer*, 'Good Abode') from that of the pyramid of Pepi I, which stood in the vicinity. Pepi II is reported to have reigned more than 90 years. Under his successor we hear of an expedition into the negro countries on the White Nile, to procure a pygmy for the King (c.2500).

Dynasties Seven to Nine form a very obscure period which has left hardly any monuments. The princes of the nomes (counties) had become so independent that the power of the king decreased. Dynasties Seven and Eight were of Memphitic, Nine and Ten of Heracleopolitan, origin. The latter had to fight continually against rebellious nomarchs (counts), especially against those of Thebes, who began to claim the royal title and finally succeeded in conquering the whole country, ruling as dynasty Eleven. The last six kings of this family (nearly all called Antef or Mentuhotep) governed a reunited kingdom. Under them Thebes, formerly an insignificant town, first became the capital of Egypt. The last King of this dynasty, Sankh-ka-rê, has left the first report of an expedition to Punt. (See below.) The Twelfth

(Theban?) dynasty seems, from recent discoveries, to have begun about 2000 B.C. This period of about 200 years (seven kings, Amenemhat I, Useratesen I, Amenemhat II, Useratesen II, Useratesen III, Amenemhat III, Amenemhat IV, and a Queen, Sebnefrurê) was considered by the later Egyptians as the golden age, especially of literature, the poetical style of which formed the model for all succeeding periods. Of the numerous "nasty" twelve and its renowned art, little has survived. Amenemhat III (q.v.) was the King Mœris of Herodotus, who gained the Province of the Fa(i)yûm for agriculture by diking off large parts from the lake formed by a branch of the Nile into that oasis. Of the so-called largest of all Egyptian temples, built at this time near the pyramid of Amenemhat III in the neighborhood of Hawarah, only a few stones remain. It does not seem that the Twelfth dynasty possessed more of Asia than the copper mines near Mount Sinai, but Nubia was gradually conquered as far as the Second Cataract, where Useratesen II established his frontier by building two strong fortresses on both sides of the Nile. The gold mines of that country were explored by the Pharaohs. After dynasty Twelve Egypt fell back into the former anarchy and strife of nomarchs, and it is likely that more than 130 princes, fighting with their neighbors for the crown, did not fill more than about a century (dynasties Thirteen and Fourteen).

Somewhat before 1700 Egypt was suddenly conquered by a foreign nation, whose rulers Manetho calls Hyksos. The name probably means "Ruler of Countries." (Consult Breasted, *History of Egypt*, p. 217.) We know nothing about the origin of these foreigners (they are usually taken for Canaanites or Turanians, though both theories lack proof) except that they had first conquered Syria. They may have been Arabians and Phœnicians. In Egypt they soon became Egyptianized. They kept only the Delta under their direct administration, leaving Upper Egypt to tributary native princes. The viceroys of Thebes (dynasty Seventeen) finally threw off the yoke of the foreign sovereign Apoph(is). After a long struggle, during which the Thebans Seknenrê III and his successor Kames died, Amasis I (Aahmes or Ahmose) put an end to the rule of the Hyksos by conquering their capital and chief fortress, Avaris (or Hat-uaret) on the northeastern frontier (c.1600). Pursuing them into Palestine, Amasis, the first ruler of dynasty Eighteen, inaugurated the period of conquests in Asia. His unlimited power (the dominion of the many nomarchs had been wiped out during the long Hyksos war) and his army, disciplined and trained in the war of independence, enabled him to conquer Palestine and Phœnicia. His son Amenophis (Amenhotep) I, dying after a brief reign, became the patron saint of the Theban necropolis. Thothmes (also called Dhutmose) I penetrated into Nubia beyond the Third Cataract and into Syria as far as the Euphrates. His son Thothmes II had to share his power with his energetic sister and wife Hatshepsu (Hatasu), who also kept his minor successor, Thothmes III (her nephew?), under her control for 22 years. In one of the finest buildings of Egypt, her temple at Deir el-bahri, is depicted, as the most remarkable event of her reign, the equipment of a

whole fleet to sail to the Abyssinian and Somali coast, called Punt (Phut in the Bible), in order to bring back gold, rare animals, and, above all, incense, together with some living incense trees to be planted at Thebes. Formerly only single ships had been sent to Punt.

After Thothmes III had come to power by Hatshepsu's death (c.1500), he showed himself the greatest conqueror among the Pharaohs. In at least 16 campaigns he conquered Palestine, Phœnicia, and Syria as far as the Lower Orontes and penetrated victoriously as far as northern Mesopotamia (Mitanni), storming Carchemish on the Euphrates and hunting elephants in that region. With his rich booty he embellished the temples of Egypt in a manner unequalled by any of his predecessors, though they had all been great builders. The gigantic temple of Ammon at Karnak is chiefly his work. His son Amenophis (Amenhotep) II (c.1480) maintained the Egyptian possessions in Asia, and so did Thothmes IV, but Amenophis II gradually lost the northern regions. He lived on good terms with Mitanni and married the sister of its King Dushrata. For an account of the cuneiform dispatches received from Asia during the reign of this King and that of his son, which were found near Tell el-Amarna, see AMARNA LETTERS.

His son, by the beautiful and influential Queen Teye, Amenophis IV (about 1410), caused a great revolution by trying to replace the old religion with a solar cult approaching monotheism. He persecuted the worship of the supreme god Ammon with special vehemence, carrying his animosity so far as to obliterate the name of the god from earlier monuments and to change his own name, which contained that of Ammon, to "The Splendor of the Sun" (Akhunaten). He removed his residence from Ammon's city, Thebes, and built a new capital at Tel el-Amarna, in Middle Egypt. After his death (about 1395) the new religion, which had previously met with great opposition, was destroyed together with its temples under the following ephemeral kings: Smenkh-ka-rê, Tutankhamôn, and Ay. King Haremheb (about 1308) completed the restoration of the old creed.

With the short-lived Rameses I, dynasty Nineteen (about 1350) begins. Sethos (Sety, Seti, or Setoy) I, his successor, a great warrior, whose tomb in Bibân el-Moluk is the finest of all the royal tombs there, attempted to win back the parts of Middle Syria which had been lost and was there entangled in a war with the Kheta or Hittites, whose kingdom seems to have had its original centre in Cappadocia. His son Rameses II, or Sesostris (c.1330 B.C.), continued this war for 20 years with varying success. Finally at the peace concluded with the Hittites and sealed by a marriage between Rameses and the daughter of their King, Syria was divided, and Egypt retained Palestine and the southern half of Phœnicia. The numerous representations of a few modest victories (chiefly that near Kadesh on the Orontes, later Laodicea and Libanum) made the Greeks believe that Rameses II had been the conqueror of half the world. However, his activity as a builder during his reign of 67 years was beyond comparison, though he usurped many monuments, replacing earlier names by his own. Perhaps two-thirds of all the monuments bear his cartouche. As he colonized Goshen (the modern Wadi Tumilat) and built there the cities of

Pithom and Rameses, he has been pointed out as the Pharaoh who oppressed the Israelites, and his son has been deemed the Pharaoh of the Exodus. But an inscription found in 1896 shows that, in the fifth year of his son Merneptah, Israel was already settled in Palestine, and that an earlier date must be sought for the Exodus. On the other hand, it is clear from the Amarna Letters (q.v.), written about 1400 B.C., that at that time Israel had not yet entered the Promised Land. The date of the Exodus must therefore be placed in the interval between these two extreme limits, or, in round numbers, between 1400 and 1250 B.C. The theory is sometimes advanced that the ancestors of Israel settled in Egypt under the Hyksos kings, but there is no evidence in support of this view. In fact, with the single exception of Merneptah's inscription, there is no mention of Israel in the Egyptian records, and nothing is known in regard to the date of the chosen people's settlement in Egypt or the length of their sojourn there. All theories upon this subject are based upon little more than pure conjecture. Under Merneptah the Libyans devastated the Western Delta, and pirates from Asia Minor and Europe ravaged its shores—the Akaywash (Achæans?), Tursh (Tyrsenians?), Shardin (Sardinians), and Luk (Lycians). These enemies joined their forces and had almost reached Memphis when they were met by the Egyptian army and utterly annihilated. Dynasty Nineteen ends ingloriously with three kings (of whom one is said to have been a Syrian usurper) and a queen.

Setnakht, the founder of dynasty Twenty, re-established order. His son Rameses III (c.1210 B.C.) repelled several invasions of the Libyans and defended Egypt and the Syrian provinces from the raids of the pirates mentioned above, as well as from barbarians coming by land from Asia Minor. A branch of the latter, however, the Philistines, settled in Palestine at that time. Rameses plundered the land of the Amorites north of Palestine. His palace and favorite temple were at Medinet Habu. The nine Ramesides after him reigned peacefully to about 1100, when the high priests of Thebes, who had become very rich, especially through the donations of Rameses III, took the crown. They had soon, however, to yield to a new dynasty (Twenty-one) from Tanis. At that time the police of Thebes gave up the task of protecting the royal tombs of dynasties Eighteen to Twenty against thieves and hid most of the royal mummies in a secret pit, where they were discovered in 1881. A few tombs, which a landslide had made inaccessible to thieves and police, were discovered intact in 1898.

The Libyan mercenaries had meantime become so powerful that dynasty Twenty-two (about 950) was founded by one of their generals, Shoshenk I (the Shishak of the Bible), who plundered Judæa and Israel under Jeroboam and Rehoboam. His successors were called Shoshenk (3), Usorkon (3), Takelot (2), and Pimay. Under dynasty Twenty-three (from Bubastus, about 800) the country again split up into many small kingdoms ruled by Libyan officers, and the way was thus left open for the attacks of the kings of Ethiopia (q.v.), who had been independent since dynasty Twenty-one. About 750 the Ethiopian Pankhy (or Piankhy) was prevented from subjecting all of Egypt by the resistance of Tefnakht, the ruler of Sais and

Memphis; but Pankhy's grandson Shabako succeeded in dethroning Tefnakht's son, the wise Bocchoris (Bok-en-renef), with whom dynasty Twenty-four came to an end (c.720?). The Ethiopians form dynasty Twenty-five. After Shabatako, Taharko (the Tirhaka of the Bible, c.700?) pursued a policy hostile to Esarhaddon, King of Assyria, who attacked Egypt in 673 and conquered it in 670. The Assyrian monarch divided the country among 20 tributary princes, descendants of the old Libyan families. The Ethiopians twice again invaded Egypt in 667 under the new King Tan(u)t-amen, but unsuccessfully. The Assyrian vassal Psammetich, Prince of Sais, a descendant of dynasty Twenty-four, aided by Greek and Carian mercenaries, made himself independent master of the country (663), when Assyria's power declined. The new dynasty (Twenty-six) is remarkable for its revival of art with archaistic tendencies. Psammetich's son Nekao (Necho) II (609-594) slew Josiah of Judah and conquered Syria as far as the Euphrates; but he soon lost it to the new Babylonian Empire, being defeated by Nebuchadnezzar at Carchemish. Necho dug the first canal connecting the Nile, and thus the Mediterranean, with the Red Sea. He also built a fleet and sent Phœnician sailors around Africa. Apries (Uahabre, the Hophra of the Bible, 588-569), the successor of Psammetich II, vainly tried to prevent the destruction of Jerusalem by Nebuchadnezzar (586). Amosis II (Amasis, 569-526), in consequence of a military revolt, first took Upper Egypt and three years later slew Apries in battle. With diplomatic skill he maintained himself against the Babylonians, and later against the Persians; but his son Psammetich III closed this flourishing dynasty by a reign of only one year. In 525 Cambyses defeated him at Pelusium, and Egypt became a Persian province.

The revolts of the Libyan officers Khabbash (487), Inarus, and Amyrtæus (460-450, aided by the Athenians) were suppressed; but in 414 the Persians were expelled, and Egypt was free from their rule until 343. In the interval, however, the country was a prey to internal strifes. The Persian reconquest was followed by many cruelties; the last Egyptian King, Nectanebus, fled to Ethiopia. Alexander occupied Egypt in 332 and founded Alexandria in 331. On the death of Alexander (323 B.C.) one of his generals, Ptolemy, son of Lagos, became Macedonian Governor of Egypt. From the first he was virtually an independent ruler, though he did not assume the royal title till 306 B.C. He was a wise and politic sovereign, and under his reign Egypt became a power of the very first rank. He conciliated his native subjects by treating with respect their religion and the long-established customs of the country. Under Ptolemy and his successors Alexandria, the new capital of Egypt, increased rapidly in importance and soon became the foremost city of the world. Its commerce was far-reaching and brought vast wealth into the hands of its merchants. As a centre of literary culture, it was even more famous than as a centre of commerce. The celebrated museum and library founded by Ptolemy I exerted a profound influence and attracted to Alexandria men of letters and of science from all parts of the Hellenic world. Ptolemy I died in 284 B.C. His grandson Ptolemy III (247-222) waged a successful war with Syria and greatly extended

the foreign possessions of Egypt. After this there followed a period of steady decline. Antiochus the Great of Syria and Philip V of Macedon deprived Ptolemy V (205-181 B.C.) of his Syrian and Egean possessions, and but for the intervention of Rome would have seized Egypt as well. Henceforth, although her commerce increased in importance, and Alexandria was still the great centre of literature and science, Egypt existed as an independent kingdom only by the sufferance of Rome and lost all external influence. Ptolemy XIII (80-52 B.C.) bequeathed his kingdom to his elder daughter Cleopatra (q.v.) and his elder son Ptolemy XIV. Cleopatra made herself sole ruler and finally terminated an adventurous career by suicide in 30 B.C. With her the kingdom of the Ptolemies came to an end, and Egypt became a Roman province.

Augustus made Egypt a Roman province under a governor of equestrian rank. It remained rather a quiet possession of the Romans. Many temples were erected under the Roman dominion. The invasion by the Ethiopians (24 B.C.) and that by Zenobia of Palmyra (270 A.D.) are the most important events of this period. The rapacious desert tribes of the Blemmyans were often troublesome. Christianity spread with special success among the Egyptians. Gnosticism and magic (on heathen models) had their origin here. Paganism was persecuted and forbidden in 391 A.D., being tolerated only on the island of Philæ until the reign of Justinian. Schismatic contests among the Christians did much harm.

**Egypt After the Fall of Rome.** After the fall of the Roman Empire Egypt almost disappeared from the knowledge of Europe, but it occupied an important place in the Mohammedan world. It was conquered by the Arabs under Amru (639-641 A.D.) and in 969 became the seat of power of the Fatimite dynasty, and its capital, Cairo, was one of the religious centres of Islam. The Ayubites succeeded the Fatimites and under Saladin (1171-93) united much of the Mohammedan world under their rule. In the thirteenth century it was politically and commercially the real heart of Mohammedanism, and the later Crusaders made it their objective point, with the idea of striking at the vital seat of the enemy's strength. The Crusaders took Damietta in 1219, but were caught in the Delta on the march to Cairo and forced to cede all their conquests (1220). Damietta was again captured in 1249, by Louis IX of France; but his army met a similar fate to that of the warriors of the Fifth Crusade in advancing on Cairo. In the retreat upon Damietta the army was destroyed, and the King was captured and compelled to pay a large ransom, a part of which was the surrender of Damietta. Under the Mameluke sultans (1250-1517), vigorous warriors but poor administrators, the country fell into poverty and anarchy. The Turkish conquest (1517) by Selim I left the power of the Mameluke chiefs nearly unchanged. In 1798 Napoleon Bonaparte invaded Egypt and defeated the Mamelukes near the pyramids; but the French forces in Egypt were expelled by the Turks, with British help, in 1801. In 1811 Mehemet Ali Pasha (q.v.) massacred the Mamelukes and formed an army which conquered parts of Arabia (1816) and Nubia (1820-22), but lost many troops in aiding the Porte during the Greek Revolution. Mehemet

Ali founded the present ruling dynasty and established himself as a practically independent ruler. In 1831 he rebelled, conquered Syria, and developed designs upon the whole Ottoman Empire; but in 1840 the intervention of Russia, England, Austria, and Prussia forced him to evacuate Syria and renew his allegiance to the Porte. He improved the agriculture and defense of the country, but nearly ruined the people by taxes and monopolies. He died in 1849, and his successors, his grandson Abbas Pasha (1849-54) and his son Said Pasha (1854-63), restored prosperity to the country and began the Suez Canal. Ismail Pasha (1863-79), who first received the title of Khedive or Viceroy from the Porte, promoted the construction of the Suez Canal by De Lesseps, extended the conquest of the Sudan begun by Mehemet Ali, but was forced by the Porte several times to reduce his army and navy. Upon his accession the Egyptian debt was \$16,000,000; in 1879 it had risen to \$500,000,000. English and French banking houses were largely concerned in the solvency of the Egyptian government, and in 1875 the Khedive sold his 176,602 shares in the Suez Canal for £4,000,000 to England, thus laying the foundation for that country's influence in Egypt. In 1876 the revenue was put under the management of European commissioners; in 1878 the Khedive's private property went to help the payment of the interest on the public debt. His reckless extravagance made the Egyptian question one of European politics, and it was closely associated with the Eastern question (q.v.) by the opening of the Suez Canal.

When Ismail, in 1879, dismissed his financial minister, Nubar Pasha, and refused the payment of interest, the European governments forced his abdication in favor of his son Tewfik (1879-92). In 1880 a dual British and French control was established, which caused a Nationalist revolt in the following year, headed by Arabi Pasha (q.v.), a colonel in the army. The demands of the insurgents were that the army should be increased to its normal strength, the Prime Minister of the Khedive, Rifaat Pasha, should be dismissed, and that a Chamber of Notables, or National Parliament, should be convened to assume the government of the people as a representative body. Tewfik was alarmed by the proportions which the revolt had assumed, and a Chamber of Notables was summoned, which met at Cairo before the end of the year. In 1882 Arabi was taken into the new Cabinet as Assistant Secretary of War. When it was found that France and England, through the Controller General, were inclined to resist all the demands of the Chamber that would limit foreign interference in the management of the finances, the resentment of the popular, or National, party rose to fever heat. Sherif Pasha, the new Premier, favored the European powers. He was therefore forced to resign, and a new ministry was appointed, with Mahmud Sami and Arabi Pasha at its head. But the Khedive and his ministry represented such opposite lines of policy that it was evident that a rupture between them was inevitable, and in the middle of May the crisis came. The Khedive's action in pardoning certain political offenders was violently attacked by the Nationalists, and England and France each sent out a fleet to Alexandria and demanded the resignation of the ministry and the exile of Arabi. The ministers obeyed,



but a popular outbreak caused the Khedive to reinstate Arabi. He was now the idol of the army and the populace, who, encouraged by their success, were threatening violence against their foreign oppressors. An ordinary street fight in Alexandria culminated in a general uprising of the native populace against the Europeans, June 11. Arabi was commissioned by the Khedive to restore order; but his known sympathy with the rioters only increased the panic of the foreign colony, which fled from the city. England and France had vainly urged the Sultan to send troops into Egypt to enforce the authority of the Khedive and to suppress the growing power of Arabi, who was virtually dictator of the country. The French hesitated to act. Great Britain in vain urged the Sultan to take a firm stand and, after inviting the coöperation of Italy, determined to take matters into her own hand. A *casus belli* was found in the fact that certain forts in the harbor of Alexandria were being armed by orders of Arabi. The English admiral, Sir Beauchamp Seymour, accordingly bombarded the town. On the next day (June 12) the insurgents evacuated Alexandria, leaving it in flames, and intrenched themselves at Kafi Dowar, about 12 miles distant. The Khedive sought refuge with the English fleet. He was formally deposed by the Nationalists, who organized a provisional government at Cairo and intrusted the defense of the country to Arabi. Meanwhile the English, after an ineffectual siege of some weeks, abandoned the attack on Kafi Dowar, and an Anglo-Indian army of 40,000 men was sent across the Isthmus of Suez, under command of Sir Garnet Wolseley. They landed at Ismailia and advanced to Tel el-Kebir, where a large army of insurgents had thrown up intrenchments. These were stormed September 13. A forced march was then made on Cairo, which was reached by nightfall. Arabi at once surrendered, the National army was disbanded, and the Khedive was restored to his authority. Arabi was sentenced to death, but the sentence was commuted to exile on the island of Ceylon.

Various reforms were introduced by the English, acting through Lord Dufferin, who was appointed Special Commissioner to Egypt. The French having taken no part either in suppressing rebellion or in the subsequent reorganization, the dual control came to an end in 1883, notwithstanding the protest of France. An army of occupation was deemed necessary for a while to preserve tranquillity, but it was promised that its size should be steadily reduced. This promise, owing to a serious outbreak of the Arabs in the Sudan (q.v.) and the inherent weakness of the khedival government, was not redeemed. Egypt became practically a dependency of England, garrisoned by English troops, and with a government whose policy is in all things directed by the representative of England, though still carried out in the name of the Khedive. The Suez Canal, the new gateway to the East, and the strategic position of Egypt with reference to the development and control of Africa, gave that country a new importance, especially for Great Britain. Egypt is still nominally a province of the Ottoman Empire; but the government of Great Britain, where half of the Egyptian national debt is held, undertook to represent the foreign creditors. The commander of the army, known as the *sirdar*, is an English officer. There is an In-

ternational Court, on which 13 European countries and the United States are represented, which has jurisdiction in cases in which foreigners are concerned. The Khedive and the government may be held responsible before his court. The finances are guarded by the International Debt Commission, on which all the Great Powers of Europe are represented. Under British control the expenditures have been brought within the receipts, taxes have been reduced, and compulsory labor and slavery have been abolished. The Sudan, subject to Egypt in some measure since 1820, with its fanatical tribes of fearless warriors, was a problem for

its control was of great strategic importance, and it was a centre of the slave trade. In 1874 Charles George Gordon (q.v.) was appointed Governor-General of the Sudan and succeeded in partially organizing the country and abolishing the slave trade. He was succeeded in 1881 by Raouf Pasha, under whom the country relapsed into barbarism. The advent of the Mahdi (q.v.), Mohammed Ahmet, in 1883, brought religious fanaticism into the struggle against Egyptian control. The rapid increase of the Mahdi's power and the defeat of the Anglo-Egyptian army under Hicks Pasha led the government to send General Gordon back to the Sudan in 1884. He was soon cut off in Khartum, and the relief expedition under Wolseley arrived too late (Jan. 28, 1885) to save him. The Sudan was left to itself until 1894, when Sir Herbert Kitchener, in a series of campaigns which proved the quality of the new Egyptian army, succeeded in re-establishing the authority of the governments over the Egyptian Sudan, his final triumph being the battle of Omdurman (Sept. 2, 1898). The defeat and death of the Khalifa in the battle of Om Debrikat in 1899 and the capture of the last Mahdist leader, Osman Digna, in the following year hastened the pacification of the country. Tewfik's son, Abbas Hilmi, who had been educated in Europe, succeeded as Khedive, Jan. 7, 1892, and proved an able and enlightened ruler. Lord Cromer, the British Consul General, has had a predominant influence in shaping the course of affairs in Egypt. The economic rehabilitation of the country has proceeded rapidly, chief among the works of public utility undertaken being the great Assuan dam, completed in 1902. By the Agreement of April 8, 1904, between France and Great Britain, the former pledged itself to abstain from interference with British policy in Egypt by not insisting upon the definite settlement of the question of occupation. Since the opening of the twentieth century the all-important political question has been that of Egyptian Nationalism. The great Pan-Islamic upheaval which marked its first decade was particularly noticeable in Egypt. In 1906 a great Mohammedan petition was presented to the Prince of Wales, then in Cairo, beseeching independence. A nationalistic party was formed under the energetic leadership of Mustapha Kamel, and at the same time the Denshawai affair stirred up the feelings of the Egyptians to a high pitch, for an arbitrary court-martial controlled by English officers had acted in this instance with great and unnecessary harshness. Earl Cromer, the great English Viceroy, resigned and Sir Eldon Gorst took his place in 1907. A lull now occurred. Gorst inaugurated a few reforms, but it was quite evident that he had no intention of



giving up Great Britain's control. There were renewed outbreaks. The students of the University of Cairo went on strike; the nationalistic press grew rapidly; the Egyptian Prime Minister was assassinated. The government promptly enforced an old press-gag law, and Mr. Roosevelt, arriving on the scene from the Sudan, aroused still further the ire of Egyptian patriots by a "Foggy" speech. In 1911 Sir Eldon Gorst took his post was taken by Lord Kitchener, who took measures for the pacification of the country by economic reforms. A plot to assassinate Kitchener was unearthed in 1912.

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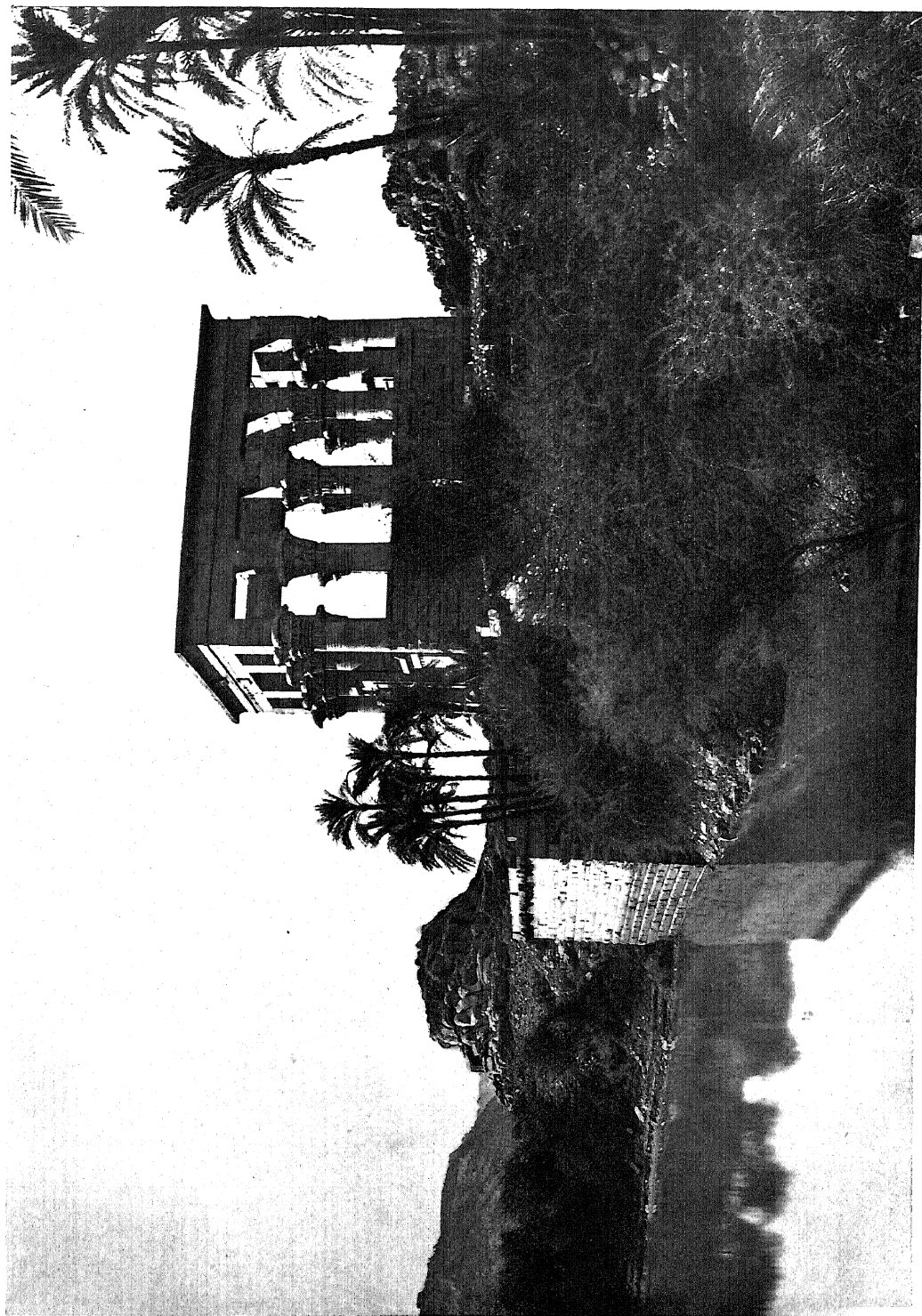
EGYPT, PLAGUES OF. See PLAGUES OF EGYPT.

**EGYPTIAN ART.** The art of Egypt is naturally divided into three main divisions: that of ancient times; the early Christian period of Coptic and Byzantine art; and the Mohammedan period, from the Arab conquest in 642 to the present time. The third of these divisions is treated under the article MOHAMMEDAN ART (q.v.); this article deals with the first two.

The date of the earliest Egyptian art is not known. Its monuments are hardly as old as the oldest Babylonian remains. But these monuments confront us with the vestiges of a highly developed civilization whose origins must have been in a far more remote antiquity. The researches of Petrie and De Morgan have uncovered many early and archaic remains, but it is not certain that even those of the Stone age antedate the earliest historic monuments. It is customary to divide ancient Egyptian art history into five periods, measured by the dynasties of the list of Manetho (q.v.): the Ancient Empire from about 3500 to 2160 B.C., covering 10 dynasties; the Middle Empire (two dynasties, 2160-1788); after the Hyksos dominion of five dynasties, the New Empire (Eighteenth-Twentieth dynasty, 1588-1150); the Saitic, or Decadent, period of the New Empire (1150-324); and the Ptolemaic Revival (Twenty-sixth-Thirtieth dynasty and Macedonian and Roman dominions, 324 B.C.-330 A.D.). The Christian art that follows, whether Coptic or Byzantine, is less Egyptian than cosmopolitan.

**Architecture.** The monuments of the Old Empire belong rather to engineering than to architecture, but, with all their simplicity, possess great material grandeur; they are almost wholly sepulchral, comprising pyramids, mastabas, or masonry tombs, and hypogea, or excavated tombs. The pyramids (see PYRAMID), over 100 in number, were erected for the burial of members of royal and noble families, and each one contains a burial chamber and a number of passages. The earliest-dated pyramid is the stepped structure at Saqqara, 190 feet high, in six steps, built of brick. There are similar structures at Abusir and Meidum. These imply possibly a knowledge on the part of the Egyptians of the stepped temple pyramids of Babylonia, also of brick. But stone soon came to be the material used for the Egyptian pyramids. This is illustrated by the three famous examples at Ghizeh, all belonging to kings of the Fourth dynasty, Khufu (Cheops), Chephrer, and Menkaura, that of the first named the greatest of all, being 482 feet high on a base 780 feet square. For persons not of royal blood the tomb took the form of a rectangular structure. (See MASTABA.) The best-preserved shrine of this period is the so-called temple of the Sphinx (q.v.), of extremely primitive architecture, consisting of a hall in the form of a T, roofed with plain stone lintels on 16 perfectly plain square stone piers. Remains of a few other temples have been found, all associated with sepulchres. During this first period there is little architectural memberment or decoration. No style has yet been formed. The Middle Empire shows a considerable change: columns appear with polygonal or fluted shafts; others of quatrefoil or clustered section, with simple capitals. The careful execution that had before been confined to the industrial arts was applied to the decoration of buildings; color, and relief sculpture embellished architecture. The rock-cut and free-

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EGYPTIAN ARCHITECTURE  
TEMPLE AT PHILÆ

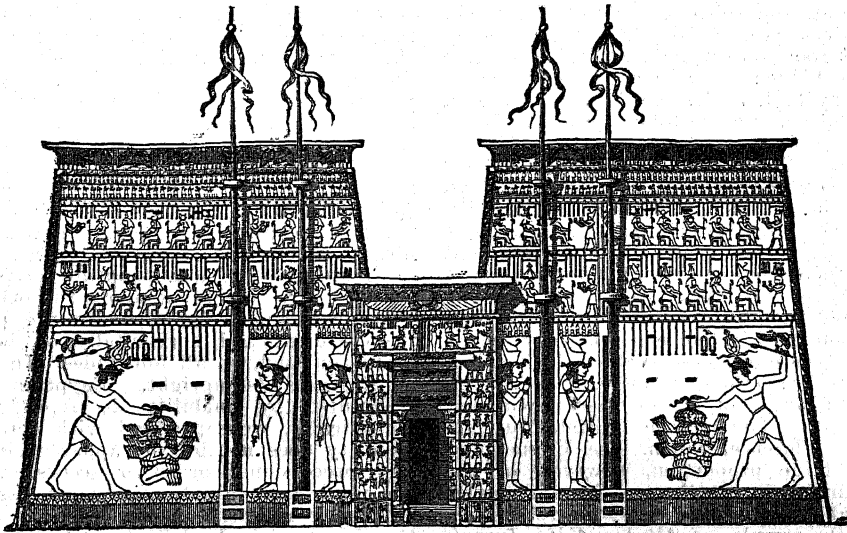
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standing tombs gave a chance to design façades, porticoes, and columnar interiors. At Abydos is the group of tombs historically most interesting, as this was from the beginning of Egyptian history the most sacred burial place. Here the usual type is free-standing. Of rock-cut tombs the most famous group is at Beni Hassan.

But the peculiar merit of this period is the origination of the grand type of *temple architecture* which was followed throughout the rest of Egyptian history. In these the column, lintel, and wall of cut stone carefully fitted and laid and secured by cramps and dowels, present the earliest examples of monumental architecture in stone. The type of this period is represented by only a few examples in ruins at Bubastis, Karnak, etc.; it received its full development after the expulsion of the Hyksos kings, under the New Empire. Aside from a few exceptions, such as the temple of Amenophis III at Elephantine, with its peristyle surrounding a cella, this type is the following: A road bordered by colossal sphinxes leads to the high-walled inclosure which hides the temple. The single imposing gateway is flanked by two tower-like pylons of very massive proportions;

grouping on the island of Philæ is the most picturesque in Egypt. Other important temples are that of Luxor, the Ramesseum, and those at Medinet-Abu, Edfu, Denderah, etc. Edfu is the most symmetrical and well preserved, but the group at Karnak is the most monumental and artistic in Egypt, the work of many monarchs of the Middle and New empires. Its hypostyle hall, measuring 170 × 340 feet, had a central nave with 12 of the highest columns ever used in Egypt, and aisles formed of 122 columns in nine rows. The capitals of the central aisle were bell-shaped; those of the side aisles were of the lotus-bud type. The temples of Philæ, Edfu, and Denderah are of the Ptolemaic period, during which the only marked changes from the style of the New Empire were the introduction of a screen wall between the front columns of the hypostyle hall, and a greater variety in the capitals, complex floral forms being especially favored. During the entire New Empire and Ptolemaic period architectural forms remained almost unchanged, except as above stated. Walls were built with a batter or slope, and surmounted by the unvarying Egyptian cornice, a huge flaring cavetto above a roll mold-



RESTORED FRONT OF AN EGYPTIAN TEMPLE WITH PYLONS AND GATEWAY

through it an open court is reached, surrounded by one or even two rows of columns, making it resemble an atrium. From this court the foremost part of the sanctuary proper is reached, the hypostyle hall, divided into aisles by rows of columns, and lighted from above or from between the front columns. Finally comes the inner sanctuary with an isolated shrine in a dark columnar hall, surrounded by small chapels. The effectiveness of this arrangement, with its gradual transition from the brilliant sunlight of the court to the intense gloom of the farthest chapel, is increased by an upward slant or stepping of the floor level and the diminishing height and size of the successive parts. This simple scheme was usually complicated by additions made by succeeding monarchs in any great shrine like Karnak or Philæ; court after court, each with its entrance pylons, were strung together or connected by avenues, and independent sanctuaries were placed side by side. The

ing recalling a bundle of reeds. Columns were of various forms; the shafts, either circular or clustered in section, tapered slightly from the base upward and bore capitals of various types. Of these the chief were the inverted bell, the bud (single or clustered), the palm, and the Hathor-headed (four masks of Hathor supporting a shrine-shaped block). The upper part of the shaft had a necking of several bands. No other moldings, no other cornice, no other details appear. On the other hand, the surface decoration was wonderfully full and varied. The columns were covered with designs, and so was every inch of the walls. The favorite form was that of extremely low relief or incised sculpture, brilliantly colored, and arranged in systematic series of panoramic pictures, according to an elaborate mythological or historic system.

It was the great kings of the New Empire, the Thothmes, Amenhoteps, Setis, and Rameses, the conquerors of the East, who were the great-

est builders; and after them no revival comes until the Ptolemaic age. There were two classes of temples of different type, many of them associated with royal tombs. One series is that of the rock-cut temples with sculptured façades, of which the most famous are at Abu Simbel (q.v.), the work of Rameses II, their façades decorated with colossal statues, and their halls an imitation of the free-standing temples. Then come the royal tombs of the New Empire, dug deep into the mountain, as at Bab-el-Moluk, and the corresponding sepulchral temples. Of these the greatest is that of Queen Hatasu at Deir-el-Bahari, uniquely picturesque and new in type, partly excavated and partly built. Others approach more the usual type, as the Ramesseum, not far from it, and the Temple of Rameses III at Medinet Habu.

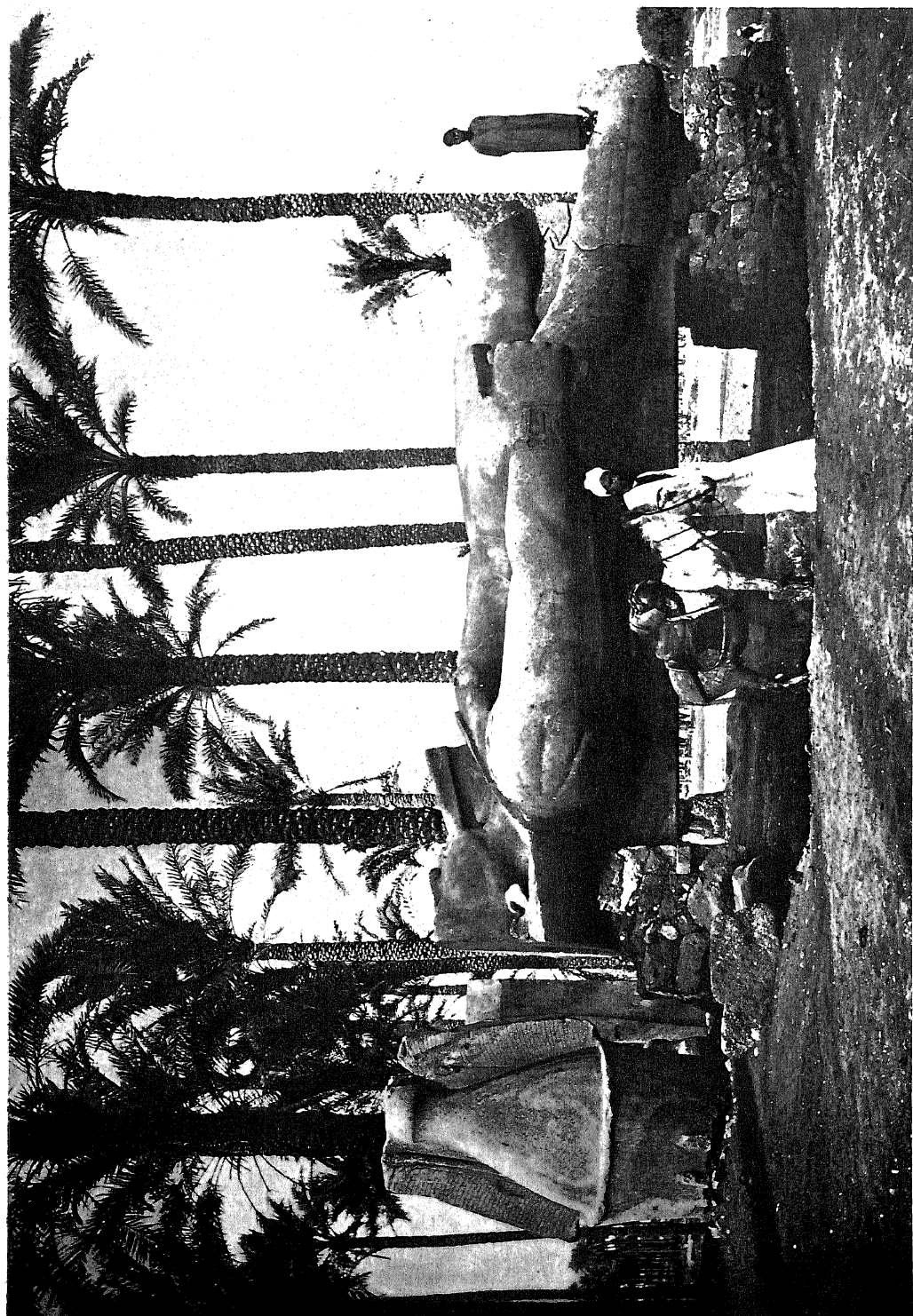
There are many remains of Egyptian civil and military architecture. At Thebes, Memphis, Bubastis, and many other cities, whole quarters remain; and the fortresses of Abydos, El-Kab, and Semneh, though of early date, are in excellent preservation, as are also the fortified walls of many cities, such as San, Saïs, and Thebes. The New Empire adopted the Asiatic type of fortifications with which its wars had familiarized it, and substituted stone for brick. In all private houses of any size the inner court and the flat roof were prominent features. The largest were hidden away in a garden or park, surrounded by high walls, and, besides the main residence, had many subordinate buildings, often as complete as those of a mediæval monastery.

**Sculpture.** While it seems probable that Babylonian architecture matured earlier than that of Egypt, it was quite the reverse with sculpture. The religious beliefs of the Egyptians led their early artists carefully to observe and copy the human figure in order to reproduce accurately each individual after death, so that the spirit and shade, the *ba* and the *ka*, should recognize their earthly tenement and be reunited to it. The sculptors were extremely prolific. The greatest collection is, of course, in the museum at Ghizeh; others of first importance are those of the Louvre, the British Museum, the Vatican, Florence, Turin, The Hague, and Berlin. A large proportion, however, of the works remain *in situ*, in the temples and tombs, both colossal statuary and series of reliefs, especially in the temples of Abydos, Edfu, Ipsambul, Philæ, and Thebes, and in the tombs at and near Beni Hassan, Memphis, and Thebes.

All the sculptures of the Old Empire have been found in tombs and have some funerary connection or significance. They are far more realistic than later works, and often have considerable value as portraits. The colossal and official style does not arise until the Middle Empire in connection with temple architecture, reaching its climax under the Rameses and Setis of the New Empire. From the beginning plastic art was used to illustrate the daily life of the people. Each tomb contained a faithful detailed representation of the possessions, occupations, person, and family of the deceased, as well as scenes of his future life. In the inner chamber were several statues as he or she appeared in life; in the chamber of offerings were other statues, the table of offerings, and especially a series of scenes in low relief, usually colored quite brilliantly on a stucco ground, not shaded, but laid on in broad masses and with strong contrasts. In the New Empire two other forms

besides the low relief became popular—sunken relief (*cavo-relievo*) and outline relief (*stiacciato*)—with the result of making sculpture even more pictorial in effect. There was never much work done in high relief, and that was nearly all during the Old Empire. The methods of quarrying, transporting, blocking out, carving, finishing, and polishing sculptures, whether in relief or in the round, are among the scenes represented. The Greek tradition of the use of wood by Egyptian sculptors in the earliest times is borne out by the discovery of a number of wooden statues of the Old Empire, chief of which is the famous standing figure of an official nicknamed the *Sheik-el-beled* (Ghizeh Museum). Acacia and sycamore were among the woods used; apparently a sacred significance was attached to this material, as, later, among the Greeks. Basalt, diorite, and red granite were the favorite stones for statuary, while reliefs were mostly in softer varieties, as limestone and sandstone. At a late period red porphyry became popular. The element of color seems to have been considered necessary in sculpture; when it was not given by the stone itself—as in basalt, diorite, and red granite—it was obtained by stuccoing and painting the softer stones, and even wood. The representation were purely conventional, and for the purpose of conveying an idea, not of producing an illusion (except in the case of the portrait statues of deceased persons). The main attempt was to show as much as possible to the beholder. Therefore in relief, figures were spread out as on a map, the head in profile (but the eye in front view), the shoulders full front, the arms and hands in profile, the trunk three-quarters, the legs and feet in profile. In scenes where several planes of figures are given, there is no attempt at perspective, but the rows are raised one above the other toward the background. In a garden the plants and trees are stacked horizontally on both sides; around a pond, on all four sides. In such cases nothing stands upright. Egyptian sculptors, undaunted by inability to reproduce scenes realistically, were prodigal with details. This inability does not become apparent in the simpler processional or other scenes, where only one plane is required, as in most Assyrian and all Greek reliefs. In such details the execution is surprisingly delicate and highly finished.

From the beginning there seem to have been two styles in sculpture, the hieratic-religious and the secular. The former was stiff, traditional, and with few types; the latter was easier, freer, and with much greater variety. The famous colossal statue of King Chephren, with hands on knees, in the familiar traditional attitude, shows also the type of slender body used for gods and kings, in contrast to the heavy, squat type—like that of the Coptic fellah—used for portraits of common folk, such as the above-mentioned *Sheik-el-beled*. Outside of any class, and the earliest large work of sculpture, is the colossal Sphinx of Ghizeh, which is now disintegrating under the changed climate. The favorite theme of the naturalistic portrait is perhaps the seated group of husband and wife, a theme in which truth to nature lasts even through the Middle Empire, as shown, for instance, in the group of Ra-Hotep and Nefert, of the Thirteenth dynasty, where the husband is of the negroid type so common before the New Empire. Outside of Egypt, the



EGYPTIAN ART  
COLOSSAL STATUE OF RAMESES II., FOUND NEAR MEMPHIS





Florence Museum is particularly rich in these family groups. There are a few cases of *genre* and other scenes which are also particularly naturalistic, such as the "Royal Scribe," at the Louvre, and the "Girl on Her Knees Washing Clothes." The representations of divinities are very material, with a type, reminiscent of totemism and fetishism: Sekhet-Bast, a lion or cat; Anubis, a jackal; Horus, a hawk; Chnum, a ram; Thoth, an ibis; Lebek, a crocodile. Usually the method was to place an animal's head on a human body, though sometimes the god was wholly human and accompanied by his animal emblem. Figures of the gods were multiplied innumerable on a small scale. The gods of Upper and of Lower Egypt were worshiped on the opposite walls of a temple, and the god's image, receiving the worship of the King, was repeated many hundreds of times in relief on the walls and columns, and even on the surfaces of the outer pylons. This was especially the case in later art. Small images of the gods in bronze, glazed earthenware, and diorite were manufactured by the million as objects of devotion, according to uniform types. The next class is that of official political art. Here also there is a traditional element. The scene of the colossal King, at whose feet cover a group of captives whom he is about to slaughter, is repeated without variation during many reigns. So is the scene of the victorious King in his chariot overturning his enemies, as sung of Rameses II in the famous poem of Pentaur. But even this political art had its realistic and free side. At Karnak the low reliefs, representing the captives defiling with their gifts, offer a splendid and rich series of types of the different races and tribes inhabiting Syria, Phœnicia, and Palestine, the artists having succeeded in conveying racial traits with very few touches. In the same way the processional reliefs of Queen Hatasu at Deir-el-Bahari are very illustrative of the products and races of the South. But of even more varied interest are the reliefs and paintings in the tombs of private persons. In one of the tombs of the Middle Empire a scene represents the migration of a tribe in patriarchal fashion, in all its details, showing how traveling was done in the age of Moses. There was a distinct phase of naturalistic revival under Amenophis IV (Akhunaten) in the New Empire; otherwise the change was toward the stiff, the colossal, and the highly finished. Under the late Saitic dynasty there was a revival in the reign of Psammetichus, with a recurrence to the grace and delicacy of the time of Seti I and Rameses II. Then, when Greek art was introduced under the Ptolemies, sculpture was more affected than architecture.

**Painting and Minor Arts.** Painting in Egypt can hardly be called an independent art. It was largely an adjunct to sculpture and architecture, making of all Egyptian art a mass of color. In the tombs, however, especially during the Fifth and Sixth, the Eleventh, Twelfth, and Thirteenth dynasties, wall paintings were as popular as reliefs, had the same characteristics, and portrayed the same themes. The minor arts always flourished. They may, in fact, be said to have been the earliest to develop. Egyptian gold and enamel jewelry, with its rich necklaces and pectorals, illustrates an art of which the earliest examples date

back to the Fourth or Third dynasty. The Egyptians applied artistic design and decoration very successfully to articles of furniture, ornament, and domestic use—to chairs, beds, mirrors, boxes, spoons, etc.,—and their artisans used wood, ivory, and the various metals with almost equal ease. These works were distributed throughout the Mediterranean basin by Phœnicians and Greeks, and so influenced the general history of design even more than the more monumental works.

**Coptic Art.** The place of early Christian art which developed in Egypt previous to the Arab conquest is interesting rather than important. The churches, of modified basilican type, are small, and more interesting for their details and as including some of the earliest vaulted churches known, than for any great architectural beauty. The oldest monasteries are those of the Copts, and those of the sixth and seventh centuries display a strong Byzantine influence in their carved ornament. Possibly the lattice screens in Coptic churches were the parents of the rich *musharabiyé* screens of the Arabic houses of Cairo. The Coptic textiles were often of great beauty, both of color and pattern. It is known that Coptic architects were employed by the Arab conquerors, as in the great mosque of Ibn Touloun.

**Bibliography.** Consult: Maspero, *Manual of Egyptian Archaeology* (revised ed., New York, 1913); Petrie, *History of Egypt*, 3 vols. (London, 1899-1905); Breasted, *A History of Egypt from the Earliest Time to the Persian Conquest* (New York, 1905). The fullest history is Perrot and Chipiez, *Histoire de l'art dans l'antiquité*, vol. i, *Egypte* (Paris, 1882), trans. by Armstrong (London, 1883). Large series of monuments are published in such illustrated works as Prisse d'Avennes, *Histoire de l'art égyptien* (Paris, 1878-79); Lepsius, *Denkmäler aus Aegypten und Aethiopien* (Berlin, 1849-59). The relation of the plastic and minor arts to life is well given in Wilkinson, *The Manners and Customs of the Ancient Egyptians* (London, 1837-41). Capart, *Primitive Art in Egypt* (Philadelphia, 1905), is a discussion of the early art of Egypt. The monumental work of Jomard, *Description de l'Égypte* (Paris, 1812- ), is still of value, though superseded by later investigations. For Coptic art consult A. J. Butler, *The Ancient Coptic Churches of Egypt* (Oxford, 1884). The finest monographs on a large scale are those published by the Egyptian Exploration Fund and the Mission Archéologique Française du Caire. See also MASTABA; OBELISK; PYRAMID; TEMPLE; TOMB; also under ABU-SIMBEL; ABYDOS; BENI HASSAN; BUBASTIS; KARNAK; LUXOR; MEMPHIS; PHILÆ; THEBES.

**EGYPTIAN BEAN.** See NELUMBO.

**EGYPTIAN CAT,** or CATFISH CAT. A wild cat of the Nile region, domesticated in ancient Egypt. See CAT.

**EGYPTIAN CHLOROSIS.** See ANKYLOS-TOMIASIS.

**EGYPTIAN EXPLORATION FUND.** A foundation promoted in 1882 by the Egyptologist Amelia B. Edwards (q.v.), for the excavation and study of Egyptian remains. Under its auspices Edouard Naville unearthed Goshen and the Temple of Bubastis; W. M. F. Petrie disclosed Naucratis and discovered fragments of the works of Euripides, Plato, and other writers; and E. A. Gardner made important finds of

pottery. An American branch was founded in 1883 by W. C. Winslow (q.v.), which rendered invaluable service in the prosecution of the work.

**EGYPTIAN MUSIC.** Except for abundant monumental evidence the information which we possess about Egyptian music is extremely meagre. It is derived either from inadequate accounts of ancient Greek authors, or from illustrations and specimens of their musical instruments. We do, however, know that music, crude and imperfect as their form of it was, has played an important rôle from before the time of the Old Empire down to the songs of the Nile boatmen of to-day. They sang odes to the gods, songs in praise of their heroes, dirges to the dead, and their entertainments were considered incomplete without musicians and dancers. From the fact that Jewish and Assyrian musical instruments were, for the most part, of the same character as the Egyptian it is not unfair perhaps to assume that the music of Egypt was also much like that of the neighboring civilized countries.

Probably, as in the case of every nation which has developed from barbarism to civilization, the first music was merely an accompaniment to the dance. Some of the earliest representations show singers clapping their hands in rhythm to the motions of dancers, and this method of marking time is used at the present day. During the Old Empire the dances were generally slow and dignified, and the accompaniment was that of voices; but with the beginning of the New Empire the *tempo* of the dances became rapid and the usual accompaniment was supplied by tambourines and castanets. The pirouette was a favorite dance, and in that, as in all their complicated figures, the use and position of the hands and the arms were of prime importance. The number of performers varied from 1 or 2 to 10 or 15; though, as the dramatic ballet was unknown, their more elaborate dances consisted rather of a number of small groups than of one integral whole.

Vocal music consisted of solos and choruses, which seem to have been entirely in unison. Women often sang without instrumental accompaniments, but the Egyptians seem to have felt that the voices of men needed the support of instruments. Many of the very ancient songs have been preserved in hieroglyphics, and though they are inferior to the Hebrew, they are remarkable for striking metaphors and naturalness of expression. Most famous, and one of the oldest of the songs, is that of the oxen treading out the corn. Various theories were formerly advanced to show that the Greeks derived their knowledge of music from the Egyptians; but though the latter had treatises on music, they seem to have had no system of notation and no definite ideas of harmony. Indeed, it is without parallel that a people so advanced in other arts as were the Egyptians should have had so little exact knowledge of the science of music. We have no definite information about their scales, though the seven-stringed lyre seems to have been tuned in conjoined tetrachords.

From the monuments we learn that the chief instruments of the Egyptians were the harp, lyre, single and double flute, lute, trumpet, sistrum, drum, tambourine, cymbals, and castanets.

Long before the lyre was known to the Greeks the Egyptians had both harps and lyres. The harp was their earliest instrument, and we have records of it before 3000 B.C. In its original form it had five or seven strings, and was extremely long (certainly over 6 feet), with a semicircular body. As it was developed, however, the number of strings was increased to 11 or 12, and, by 1300 B.C., to 22, while its size was greatly reduced. The strings (as on all Egyptian stringed instruments) were of catgut and were at the top wound around pegs which passed through the frame. At no time, however, did the Egyptians have pedals, or even, as in the Welsh harps, a double set of strings; consequently, unless retuned, they could be played but in one key. The ornamentation of harps was most elaborate, the heads and bodies being exquisitely carved and painted. Although the harp always remained a national instrument, its popularity was eclipsed later by the lyre, the Egyptian form of which had from 6 to 20 strings and was considerably larger than its Grecian derivative. At a very early time flutes were in use. The long flute was held in a slanting, perpendicular position and the short flute in a horizontal. The number of apertures varied from three to five. Considerably later the double flute superseded the other two. It was played with both hands, one tube giving the melody while the other droned a monotone accompaniment.

By 400 or 500 B.C., in addition to the various forms of harp, lyre, and double flute, there were the *te-bouni* (a sort of banjo), the shoulder harp, and several kinds of drums. The *te-bouni* had a long neck and a cylindrical body over which parchment was stretched. It sometimes had two or three strings, but generally only one, and in subsequent centuries the monochord (q.v.) was developed from it. The shoulder harp was a link between the harp and guitar. A specimen preserved in the British Museum has a neck 22 inches long, a body 19 inches long and 4 inches wide, and 4 strings. As its name implies, it is played when resting on the shoulder. There were two common forms of drums, the larger one being a barrel-shaped instrument about 3 feet long and the smaller a cone-shaped earthenware vessel over the open end of which parchment was stretched. Still later were added the *sistrum*, a sort of rattle; and the *trigonon*, a triangularly shaped stringed instrument; the *tamboura*, a form of lute, sometimes provided with frets, and played with a plectrum; and the tambourine. Besides the principal instruments already enumerated, there were at different times numbers of derived instruments, varying slightly in form from their prototypes. The musical instruments used in war were trumpets, cymbals, and drums. In earliest times the musicians were generally men, but later women took their places, although there were always certain instruments which seem to have been the peculiar property of each sex. The patron gods of music and the dance were Athor, the Egyptian Aphrodite, and Bes, the dwarf god.

The modern musical instruments of the Egyptians are practically those of the Arabians. (See **ARABIAN MUSIC**.) The study of music is not pursued, but that there is a natural love of it is shown by the songs of the country folk, laborers, and boatmen at their work. The Nile sailors are particularly famous for

their songs, of which there is a considerable variety, many of them having been handed down from generation to generation for centuries.

For a general sketch of Egyptian music, consult: Mathews, *A Popular History of the Art of Music* (Chicago, 1894); H. Smith, *The World's Earliest Music* (London, 1904), pp. 25-62; and Goddard, *The Rise of Music* (ib., 1907), pp. 11-38; for more elaborate treatises, Engel, *Music of the Ancients* (ib., 1864); Wilkinson, *The Ancient Egyptians*, vol. i. (ib., 1879); and for examples of modern Egyptian songs, MacGregor, *Eastern Music* (ib., n. d.).

**EGYPTIAN PAPER PLANT.** See CYPERUS; PAPYRUS.

**EGYPTIAN QUESTION, THE.** See EGYPT.

**EGYPTIAN RICE CORN.** See SORGHUM, *Nonsaccharine*.

**EGYPTIANS, GOSPEL OF THE.** See APOC-RYPHA, section *New Testament*.

**EGYPTIAN SUDAN.** See SUDAN, ANGLO-EGYPTIAN.

**EGYPTIAN VERSIONS.** See BIBLE.

**EGYPTIAN WATER LILY.** See LOTUS.

**EGYPTOLOGY.** The study of the language, history, and antiquities of ancient Egypt. As early as the sixteenth century the monuments of Egypt began to attract the attention of European scholars, and between 1529 and 1589 some ineffectual attempts were made to decipher the Egyptian hieroglyphics. In the following century the subject was revived by the learned Jesuit, Father Athanasius Kircher, one of the foremost scholars of his time, whose astonishing activity and versatility were exhibited in many fields of research. Kircher proceeded upon the mistaken theory that the hieroglyphic writing was a sort of symbolism for conveying abstruse religious mysteries, the individual characters being purely ideographic symbols. His efforts were therefore not more successful than those of his predecessors, and his fantastic renderings of hieroglyphic texts are among the most remarkable curiosities of Egyptological literature. But though he failed in his main object, his works did much to excite an interest in Egyptian antiquities, and he also rendered valuable service by introducing the study of Coptic into Europe. His Coptic grammar, entitled *Lingua Aegyptiaca Restituta* (Rome, 1643-44), was the first published by a European scholar and for a long time formed the basis of all work done in this field. Kircher was followed by Lacroze, Wilkens, Mingarelli, Quatremère, Zoëga, Jablonski, and many others, who did much to develop the study of Coptic and of Egyptian antiquities and thus prepared the way for further progress. Down to the end of the eighteenth century hardly any progress was made in the decipherment of the hieroglyphics. Kircher's theory was, however, gradually discredited, and the belief gained ground that the hieroglyphic inscriptions were composed in the language actually spoken by the ancient Egyptians, and that they dealt with history, science, art, and other subjects of a more material character than religious mysteries. Professor Tybörser (1734-1815), of Rostock, was led by careful analysis of many texts to the correct conclusion that "certain characters served merely to determine the meaning of words (see Hieroglyphics), and the learned Coptic scholar Zoëga (1755-1809) was the first to point out that some of the characters at least

had purely phonetic values, and that the groups of signs inclosed in oval rings must represent the names of kings. This, however, was practically all that was known in regard to the subject, and many fanciful theories still prevailed. The means of solving the riddle was at length furnished by the famous Rosetta stone (q.v.), discovered in 1799, which contains a decree of the Egyptian priests in favor of Ptolemy V Epiphanes (205-181 B.C.), composed in Greek, with two parallel versions—one in the vernacular, written in the Demotic character, and the other in the classical language of ancient Egypt, written in hieroglyphics. The upper part of the hieroglyphic text was broken away, only the last 14 lines remaining; while the Greek and Demotic texts were nearly complete, and for this reason the Demotic portion was selected for the first attempts at decipherment. The distinguished French Orientalist, Baron Sylvestre de Sacy (1758-1838), by careful comparison of the Greek and Demotic texts, was able to distinguish in the latter several of the proper names occurring in the decree, and in his *Lettre au Citoyen Chapal sur l'inscription égyptienne du monument trouvé à Rosetta* (Paris, 1802) pointed out the Demotic groups corresponding to the names of Ptolemy, Berenice, and Alexander. This achievement was, however, surpassed by the Swedish scholar J. D. Akerbald (1763-1819), who established the phonetic values of nearly all the Demotic characters occurring in the proper names and also by the aid of Coptic determined the meaning of several words of the text. His results were published in his *Lettre sur l'inscription égyptienne de Rosette adressée au Citoyen S. de Sacy* (Paris, 1802). Following these investigators, the English physicist Dr. Thomas Young (1773-1829) was able through careful study of many Egyptian inscriptions and papyrus rolls to distinguish between the Hieratic and the Demotic scripts and to determine the meaning of a number of groups of characters, although ignorant of their phonetic values. Utilizing Zoëga's conjecture that the groups of signs in oval rings were royal names, Young next pointed out the hieroglyphics equivalent for the name of Ptolemy in the Rosetta text and attempted to analyze it. The name is written with seven alphabetical characters (P t o l m i s), and three of them (P, t, and i) Young determined correctly. Of the remaining four he took the letter o for a silent determinative, and explained the letters l, m, and s as syllabic signs, reading them as *ole*, *ma*, and *os* respectively. He also recognized the name Berenice in a hieroglyphic inscription from Karnak, but in it he correctly determined but one additional character, the letter *m*. In his attempts to decipher other hieroglyphic names he was completely unsuccessful, and thus the sum of his achievements in hieroglyphic decipherment was the determination of four alphabetical characters. While to Young belongs the credit of being the first to assign correct phonetic values to a few hieroglyphic signs, the true credit for the decipherment of the Egyptian hieroglyphics and for the foundation of modern Egyptology belongs to Jean François Champollion (q.v.). Born at Grenoble in 1790, he early applied himself to the study of Egyptian antiquities, was a master of Coptic, and at the age of 24 was known as the author of an important work on the history and civil-

zation of ancient Egypt—*L'Égypte sous les Pharaons* (2 vols., Paris, 1811-14). In his investigations of the hieroglyphs Champollion, with Young, worked upon the theory that the characters used for writing royal proper names were purely alphabetic. On a small obelisk from Philæ, containing parallel hieroglyphic and Greek inscriptions, he read and correctly analyzed the names of Ptolemy and Cleopatra, and by substituting the phonetic values thus obtained in a large number of other hieroglyphically written names, he was able at once to control his results and to extend his system. In this way he was soon able to make out all the alphabetic characters and to read the names, not only of Ptolemaic kings and of Roman emperors, but also of the Pharaohs of the Old Empire. In the course of subsequent investigations he discovered the use of the ideograms and determinatives and surmised at least the phonetic employment of the syllabic signs. He published an outline of his system in his celebrated *Lettres à M. Dacier relatives à l'alphabet des hiéroglyphes phonétiques employé par les Égyptiens* (Paris, 1822), and developed it more fully in his *Précis du système hiéroglyphique des anciens Égyptiens* (ib., 1824; 2d ed., 1827-28). Until his death Champollion devoted himself with wonderful energy and success to the elucidation of the language, history, religion, and antiquities of ancient Egypt and left, in addition to his published works, a large mass of manuscript. His *Grammaire égyptienne* (ib., 1836-41) and his *Dictionnaire égyptien* (ib., 1841-46) were not published until after his death.

Champollion's results were not received without reserve. Among the chief opponents of his system were Spohn and Seyffarth, both professors at Leipzig. Seyffarth, who developed the system of Spohn, held the erroneous theory that the hieroglyphic characters were, with scarcely any exception, purely phonetic, and he even read the determinatives (see **HIEROGLYPHICS**) as separate words. His system thus formed the opposite extreme to that of Kircher, and his translations are almost as fantastic as those of his seventeenth-century predecessor. Seyffarth did much to retard the progress of Egyptology, but his system was finally discredited.

Of a very different character was the work of the distinguished German scholar Karl Richard Lepsius (q.v.). In his *Lettre à M. Rosellini sur l'alphabet hiéroglyphique* (Rome, 1837), Lepsius submitted Champollion's system to a searching criticism, and, while clearly proving its general correctness, he indicated a number of points in which revision was necessary. From 1842 to 1845 he headed the archæological expedition sent out by King Frederick William of Prussia to explore Egypt and Nubia. The results of the expedition were published under Lepsius' editorial supervision in the magnificent *Denkmäler aus Aegypten und Aethiopien* (6 vols., Berlin, 1849-58), which contains careful drawings and architectural plans of all the principal monuments of Egypt accessible at that time as well as a remarkably extensive collection of inscriptions dating from all periods of Egyptian history. This great work is one of the chief monuments of modern Egyptology. In 1866 Lepsius had the good fortune to find at Tanis the celebrated *Decree of Canopus*, issued by the Egyptian priests in favor of Ptolemy III Euergetes and dating from the year 238 B.C.

The inscription is in hieroglyphs, Demotic, and Greek, and all three are all in an excellent state of preservation. A duplicate of it, found at Damanhûr in 1881, was published by Pierret under the title *Le décret trilingue de Canope* (Paris, 1881).

The first Egyptologist who really translated complete texts was the French academicien Vicomte Emmanuel de Rougé (died 1872). Applying strict philological methods, he pointed out, in his *Mémoire sur l'inscription d'Akhmes* (Paris, 1851), in his *Étude sur une stèle égyptienne de la bibliothèque impériale* (ib., 1856-59), and in other works, the manner in which Egyptian texts should be interpreted and explained, and his *Chrestomathie égyptienne* (ib., 1867-76) completely revolutionized the treatment of Egyptian grammar. In the explanation of hieratic texts, hitherto much neglected, he was also successful, and in 1856 he read before the Institute of France a translation of nearly the whole of the poem celebrating the exploits of Rameses II in his war with the Hittites. In this special department of Egyptology he was, however, surpassed by his compatriot François Joseph Chavas, whose *Le papyrus magique Harris* (Châlons-sur-Saône, 1860) and *Voyage d'un égyptien en Syrie, en Phénice, en Palestine, etc.* (Paris, 1866)—the latter published in collaboration with the English Egyptologist W. Goodwin—may be said to have placed the study of hieratic texts upon solid grounds.

The study of Demotic texts, neglected after the death of Champollion, was revived by Heinrich Brugsch (q.v.), whose *Grammaire démotique* (Paris, 1855) formed the basis of subsequent work in the field. In more recent years Eugène Revillout (*Chrestomathie démotique*, ib., 1870-80; *Nouvelle Chrestomathie démotique*, ib., 1878) and J. J. Hess (*Der demotische Roman von Stne Ha-m-us*, Leipzig, 1888; *Der gnostische Papyrus von London*, Freiburg, 1892) deserve mention as specialists in Demotic. Among the many important works of Brugsch, however, the chief place must be assigned to his *Hieroglyphisch-demotisches Wörterbuch* (7 vols., Leipzig, 1867-82). The influence of this great thesaurus of the language upon the development of Egyptological knowledge has been important in the highest degree. Pierret's *Vocabulaire hiéroglyphique* (Paris, 1875) is merely an abridgment of Brugsch's great work. Levi's *Vocabolario geroglifico-copto-ebraico* (Turin, 1887-89) has contributed little to the advancement of Egyptian lexicography. A new and comprehensive Egyptian dictionary was in 1902 in course of preparation in Germany, under the direction of Prof. Adolf Erman, of Berlin, but he did not expect that it would be ready for the press for several years. Professor Erman has the distinction of having inaugurated the historical method in the study of Egyptian grammar. It was he who first accurately defined the characteristic features of the several periods of the language and treated the three earliest stages in his works: *Neuägyptische Grammatik* (Leipzig, 1880); *Die Sprache des Papyrus Westcar* (Göttingen, 1889); *Ägyptische Grammatik* (Berlin, 1894). See **EGYPT, Language**.

That Coptic studies have kept pace with other branches of Egyptology is due to the labors of scholars like Peyron, Schwartze, Tattam, Stern, De Lagarde, Amélineau, Hymernat, and Steindorff.

**Archæological Exploration in Egypt.** Archæological research has been carried on in Egypt, with some intermissions, for over a century. In 1798 the Emperor Napoleon took with him to Egypt a scientific commission to explore the monuments of the country, and the results of their investigations are published in the splendid work, *Description de l'Égypte* (Paris, 1809-29), comprising 10 volumes of text and 14 volumes of plates. The work of the commission sent out by King Frederick William of Prussia, which resulted in the publication of the famous *Denkmäler*, has been mentioned above. Important collections of texts and memoirs of travel have also been published from time to time by individual explorers. For the past 50 years both the French and the Egyptian governments have actively fostered the advance of Egyptological studies, and since 1880 the former government has maintained at Cairo a permanent mission (founded by Maspero) for the prosecution of archæological investigations and for training promising students in advanced work. The mission has published a valuable series of memoirs, containing a large number of texts dating from various historical periods, *Mémoires publiées par les membres de la mission archéologique française au Caire* (Paris, 1884 et seq.). The work of the Anglo-American Society, the Egyptian Exploration Fund, founded by Miss Amelia B. Edwards in 1882, has been very fruitful. Many ancient sites have been explored and many interesting discoveries have been made. Up to the present time the society has published more than 50 valuable memoirs, and its annual reports give a comprehensive survey of the progress of Egyptology throughout the world. The British School of Archæology in Egypt as well has published to date 15 volumes on sites and material connected with the archæology.

A very large number of Egyptian inscriptions and papyri have been published by the different museums and by individual scholars. In this direction, as also in other ways, important service has been rendered by a number of periodicals devoted wholly or in part to the interests of Egyptology. *Zeitschrift für ägyptische Sprache und Alterthumskunde* (Leipzig, 1863 et seq.), *Recueil de travaux relatifs à la philologie et à l'archéologie égyptiennes et assyriennes* (Paris, 1870 et seq.), and *Transactions of the Society of Biblical Archæology* (London, 1878 et seq.), deserve special mention in this connection. The *Revue égyptologique* (Paris, 1880 et seq.) deals more especially with Demotic subjects.

Since the time of Champollion, Egyptology has advanced with steady progress and to-day stands upon a firm scientific basis. For the past half century hardly a year has passed unmarked by some important discovery. Among the many scholars to whose labors these great results are due, it is difficult to particularize; but the names of Mariette, Déveria, Pierret, Maspero, De Morgan, Grébaut, and Bouriant, in France, of Hinks, Birch, Le Page Renouf, Wilkinson, Goodwin, Griffith, Flinders Petrie, Newberry, and Budge, in England, of Dümichen, Ebers, Eisenlohr, Wiedemann, Steindorff, Sethe, Von Bergman, and Spiegelberg, in Germany, of Von Lemm and Golenischeff in Russia, of Etemans and Pleyte in Holland, of Rossi, Schiaparelli, and Guidi, in Italy, and of the Swiss scholar Naville, may be mentioned with-

out fear of invidious distinction. The literature of the subject in its various departments is most extensive, and it is unfortunate that no complete bibliography exists. Jolowicz, *Bibliotheca Egyptiaca* (Leipzig, 1858-61), and Prince Ibrahim Hilmy, *The Literature of Egypt and the Soudan, from the Earliest Times to the Year 1885, Inclusive* (London, 1886-88), bring the subject down to 1885. The numerous Egyptological books and articles that have appeared since then must be sought in the *Orientalische Bibliothek* (Berlin). See EGYPT, and the articles on various special subjects alluded to in this article.

**EHEBERG**, a'e-bërk, KARL THEODOR VON (1855- ). A German political economist. He was born and educated at Munich and in 1882 was called to the chair of political economy at Erlangen. A work of considerable value is his *Finanzwissenschaft* (3d ed., 1891; new ed., 1909), in which the subject of finance is treated in a very thorough and scholarly manner. His other works include *Ueber das ältere deutsche Münzwesen und die Hantirung desselben* (1879), and *Das Reichsfinanzwesen* (1908).

**EHKIBI**. See MAHRA.

**EHLERS**, a'lërs, ERNST HEINRICH (1835- ). A German zoologist. He was born at Lüneburg and was educated at Göttingen and Munich. In 1860 he was appointed professor of zoology at Erlangen and in 1874 was called to the chair of zoology and comparative anatomy at Göttingen. He also became associated with A. von Reichenow, of the *Zeitschrift für wissenschaftliche Zoologie*. His principal works are: *Zoologische Beiträge*, with W. Kefersteine (1861); *Die Borstenwürmer* (1864-68); *Hypophorella expansa* (1876); *Florida-Anneliden* (1887); *Zur Kenntnis der Pedicellinen* (1890); *Magellanische Anneliden Gesammelt während der Schwedischen Expedition nach der Magellan-Ländern* (1900); *Neuseeländische Anneliden* (1904).

**EHLERS**, OTTO EHRENFRIED (1855-95). A German traveler, born in Hamburg. He was educated at Jena, Heidelberg, and Bonn, went to East Africa in 1887, and subsequently visited India, the Andaman and Nicobar islands, as well as Siam, French Indo-China, Korea, and Japan, returning to Germany by way of the Hawaiian Islands and the United States. His second tour took him through India, Samoa, Kaiser Wilhelm's Land, and finally to New Guinea, which country he endeavored to traverse. He was shot by natives accompanying him. His works include: *An indischen Fürstenthöfen* (2 vols., 1883; 5th ed., 1898); *Im Sattel durch Indochina* (1894); *Samoa, die Perle der Südsee* (3d ed., 1896); *Im Osten Asiens* (4th ed., 1900).

**EHLERS**, RUDOLF (1834-1908). A German Protestant theologian. He was born in Hamburg and was educated at Heidelberg, Berlin, and Göttingen. After holding a pastorate at Stolberg, near Aix-la-Chapelle, he was, in 1864, called to the Protestant Reformed Church at Frankfort-on-the-Main, where he exercised a considerable influence as a theologian, and 14 years afterward was appointed consistorial counselor. In 1879 he became coeditor of the *Zeitschrift für praktische Theologie*. His works include the following: *Evangelische Predigten* (1873); *Das alte Gesetz und die neue Zeit* (1877); *Bilder aus dem Leben des Apostels Paulus* (1886);

*Richard Rothe* (1906); and a Latin work on the influence of the ancient philosophies upon the Christian apologists of the second century, for which a prize was awarded by the faculty of Göttingen.

**EHNINGER**, an'ing-ēr, JOHN WHETTON (1827-89). An American painter and etcher, born in New York City. He was a pupil of Couture in Paris and afterward studied at Düsseldorf. Among his paintings, which include landscape and figure subjects, are: "Peter Stuyvesant" (1850); "Death and the Gambler"; "Autumn Landscape" (1867); "Twilight from the Bridge of Pau" (1878). He was a clever and versatile draftsman and is perhaps best known for his illustrations of Longfellow's *Seaside Stories* (1858) and Irving's *Dolph Heyliger and Ye Legend of St. Gwendolyn* (1867). The drawings for the latter were considered so delicate that they were reproduced by photography—an unusual method in that day.

**EHNENBERG**, a'ren-bērk, CHRISTIAN GOTTFRIED (1795-1876). A German naturalist, born at Delitzsch. He studied at first theology in Leipzig and then medicine and the natural sciences in Berlin. From 1820 to 1826 he traveled extensively in Egypt and Arabia and afterward accompanied Alexander von Humboldt to the Ural Mountains and Central Asia. In 1826 he became extraordinary professor of medicine in Berlin and in 1839 was made full professor. From 1842 he was perpetual secretary of the Academy of Sciences. Among his earlier works are several books of travels; also *Symbolæ Physicæ seu Icones et Descriptiones Mammalium* (1828-33); *Die Korallentiere des Roten Meeres* (1834). His most important works were on infusoria, his investigations of which were epoch making. His contributions on this subject were: *Organisation systematik und geographisches Verhältniss der Infusionstierchen* (1830); *Die Infusionstierchen als vollkommene Organismen* (1838); *Fossile Infusorien* (1837); *Mikrogeologie* (1854).

**EHNENBREITSTEIN**, a'ren-brit'stfn. A town and fortress of Rhenish Prussia, picturesquely situated on the right bank of the Rhine, directly opposite Coblenz, with which it is connected by a bridge of boats and a railway bridge. It has manufactures of tobacco, leather, flour, bricks, and soap, and carries on a flourishing trade in wine, corn, and iron, and has two cattle markets and four annual fairs. Pop., including garrison, 1900, 5302. The fortress of Ehrenbreitstein occupies the summit of a precipitous rock 385 feet above the river and has been called the Gibraltar of the Rhine on account of its great natural strength and its massive fortifications. The French attempted to take the stronghold in 1688 and failed, but in 1799, after unsuccessful attacks in 1795, 1796, and 1797, and finally a siege of 14 months, they succeeded in capturing it. They retained it only till the Peace of Lunéville (1801), when they retired, blowing up the fortifications behind them. Immediately after the close of the Napoleonic wars the construction of new fortifications on a vast scale was begun, and was completed in 1826 by General Von Aster. The scenery around Ehrenbreitstein is of remarkable beauty.

**EHNENSVÄRD**, a'ren-svård, AUGUSTIN, COUNT (1710-72). A Swedish soldier and military engineer. At the age of 24 he invented a device for increasing the force of projectiles. He built the fortifications of Sveaborg (1749)

and created the Swedish coast fleet (1756). For his services in the Seven Years' War he was made a field marshal. There is a fine monument to his memory at Sveaborg.

**EHNENSVÄRD**, KARL AUGUST, COUNT (1745-1800). A Swedish admiral, author, and art critic, a son of Count Augustin Ehrensvärd. He became an admiral at the age of 39 and fought the first naval battle of the Russian War, at Svenskund, but was dismissed because of his retreat. After the death of Gustavus III he was reappointed to the chief command of the navy (1792), but resigned two years later. The remaining years of his life were devoted entirely to scientific studies and to the artistic researches which secured for him a high rank as a critic. His principal works are *Resa till Italien* (2d ed., 1819) and *De fria konsternas filosofi* (1786), in which he evinces a strong predilection for the classics of Greece and Rome. His collected works have been frequently reprinted (latest ed., Stockholm, 1866).

**EHRLE**, ēr'le, FRANZ (1845- ). A German Jesuit scholar, born in Isny, Württemberg. He was educated at Münster, Westphalia, at the Maria-Laach in Freiburg, and at Ditton Hall, Lancashire, having been admitted to the Society of Jesus in 1861. In 1877-78 he was chaplain of Prescott Workhouse and of St. Xavier's, Liverpool, and then for two years he was editor for the Stimmen von Maria-Laach. After a decade (1880-90) of historical study in Rome and elsewhere, he became a member of the administrative council of the Vatican Library, of which he was appointed prefect in 1895. He received honorary degrees, not only from Münster (1902) and Louvain (1909), but from Oxford (1899) and Cambridge (1905). With Denifle (q.v.) he edited (1885 et seq.) the *Archiv für Literatur- und Kirchengeschichte*. Among his many published works mention should be made of *Beiträge zur Geschichte und Reform der Armenpflege* (1881); *Historia bibliothecæ pontificum tum Bonifatianæ tum Avenionensis* (1889); a study in French (1890) and Italian (1897) of Pinturicchio's frescoes in the Borgia apartment of the Vatican; and editions of many valuable Vatican manuscripts, particularly those with miniatures.

**EHRlich**, ēr'lik, HEINRICH (1822-99). A German pianist and musical author. He was born in Vienna and studied under Henselt and Thalberg. He was for some time court pianist to King George V of Hanover and became established in Berlin in 1862, where he was made teacher of the pianoforte at the Stern Conservatory (1864-72 and 1886-98). In addition to musical criticisms and other writings in the *Berliner Tageblatt*, *Die Gegenwart*, and the *Neue Berliner Musikzeitung*, his publications include: *Wie übt man am Klavier* (2d ed., 1884; Eng. trans., New York); *Die Ornamentik in Sebastian Bach's Klavierwerken; Dreissig Jahre Künstlerleben 1862-92* (1893); *Schlaglichter und Schlagschatten aus der Musikwelt* (1872); *Aus allen Tonarten* (1888); *Die Ornamentik in Beethoven's Sonaten* (1896); *Musik-Asthetik von Kant bis auf die Gegenwart* (1881); *Moderne Musikleben* (1895). His edition of Tausig's *Technical Studies* is well known.

**EHRlich**, PAUL (1854- ). A German physician, famous for his researches in experimental therapeutics. He was born in Strehlen, Silesia, and was educated at Breslau, Strassburg, Freiburg, and Leipzig, receiving the degree



of M.D. in 1878. In 1885 he was appointed assistant in the University clinic at Berlin, where he became privatdocent in 1889 and in the next year a member of the new Institution for Infectious Diseases and professor in the University. He was appointed (1896) director of the Royal Institute for Serum Research (at Steglitz), which in 1899 was removed to Frankfurt and became the Royal Institute for Experimental Therapeutics. He delivered the Croonian lectures in 1900 and the Harben lectures in 1907, and he received honorary degrees from Göttingen, Chicago (1904), Oxford (1907), and Breslau (1911), many orders and decorations, and, in 1908, the Nobel prize for medicine, with Metchnikoff. He made important studies in the histology of the blood and in immunity reactions and did research work in cancer; devised one of the most important methods of staining for the study of the nervous system; in general, greatly improved the technique of serum propagation; and in particular experimented with fuchsin injections on animals suffering from sleeping sickness; and—his greatest claim to fame and gratitude—discovered salvarsan (Ehrlich, 606) and neosalvarsan (Ehrlich, 614), arsenic compounds, of great efficacy in the treatment of syphilis. His writings include: *Farbenanalytische Beiträge zu Histologie und Klinik des Blutes* (1891); *Wertbestimmung des Diphtherieheilserums* (1897); *Anämie*, with Lazarus (1898); *Experimentelle Carcinomastudien an Mäusen* (1908); *Partialfunktion der Zelle* (1908); *Beiträge zu experimentellen Pathologie und Chemotherapie* (1908); with S. Hata, his assistant in the discovery of salvarsan, *Die experimentelle Chemotherapie der Spirillosen* (1910); *Abhandlungen über Salvarsan* (1911–12). For a popular summary of his work, consult Marks, "Paul Ehrlich," in *McClure's*, vol. xxxvi, pp. 184–200.

**EHUD.** The name of one of the judges in Israel before the establishment of the kingdom. The "judgment" he brought upon a powerful enemy is described in Judg. iii. 12–30. Having carried tribute to Eglon (q.v.), King of Moab, he departed, but returned, gained admission on the ground that he had an oracle to present, stabbed the unsuspecting King, and delivered his people. As Ehud occurs, in 1 Chron. vii. 10, as the name of a clan, and Gera, his reputed father, likewise in 1 Chron. viii. 3, the historical character of this hero has been doubted. The desire to celebrate the tribe of Benjamin, and especially the zeal of one of its clans, may have led to the story. Consult: Nöldeke, *Untersuchungen zur Kritik des alten Testaments* (Kiel, 1869); Winckler, *Geschichte Israels* (Leipzig, 1895); Judges (New York, 1895); Kittel, *Handbuch des Volkes Israel*, vol. ii (Gotha, 1894); Wellhausen, *Israelitische und jüdische Geschichte* (7th ed., Berlin, 1914).

**ÉIBAR**, a'è-bär. A town in the Province of Guipúzcoa, Spain, 34 miles by rail east by south of Bilbao. It is noted principally for the manufacture of small arms and metal articles for decorative purposes. Pop., 1900, 6459; 1910, 9659.

**EIBENSTOCK**, 'ben-stök. A town in the Zwickau District, Saxony, Germany, near the right bank of the Mulde, 17 miles southeast of Zwickau. Its principal edifice is a Romanesque church dating from 1864. It is an industrial

centre, the chief seat of the tambour embroidery manufactures, has manufactures of chemicals, brush handles, leather, beer, and tobacco, and is a cattle market. In the vicinity are tin mines which have been worked since the twelfth century, but are now practically worked out. Pop., 1900, 7468; 1910, 9528.

**EICHBERG**, ik'bèrk, JULIUS (1824–93). A German-American musician. He was born in Düsseldorf, studied composition in Brussels under Fétis, and the violin under Meerts and Bériot, and obtained the first prizes in both subjects at the Conservatory. From 1858 until his death he lived in Boston, where he was director of the Boston Conservatory of Music, general supervisor of musical instruments in the Boston public schools, and head of Eichberg's School for Violin Playing. Among his compositions are *The Doctor of Alcántara* (1862), which is one of the best operas written in America, and *The Rose of Tyrol* (1865).

**EICHELBERGER**, ik'el-bèrk'ër, WILLIAM SNYDER (1865– ). An American astronomer, born in Baltimore, Md. He graduated (1886) from Johns Hopkins University, assisted (1889–90, 1896–98) on the *Nautical Almanac*, of which he became director in 1910, taught (1890–96) mathematics and astronomy at Wesleyan University, Conn., and after 1900 was professor of mathematics in the United States Naval Academy. After 1902 he was head of various departments in the Naval Observatory, and in 1901 and 1905 respectively he was in charge of the United States eclipse stations at Fort de Kock, Sumatra, and Daroca, Spain. He is author of articles in the *Astronomical Journal* and of papers in government publications.

**EICHENDORFF**, ik'en-dörf, JOSEPH, BARON VON (1788–1857). A distinguished German poet, born at Lubowitz (Upper Silesia). He studied at Halle and at Heidelberg, where his poetic talent was awakened by Armin, Brentano, Creuzer, Görres, and others. His early original work included fugitive verse, published under the name of *Florens*, and a prose tale, *Ahnung und Gegenwart* (1811). From 1813 to 1815 he participated in the War of Liberation, and from 1831 until his resignation in 1845 served as an official in the Prussian Ministry of Public Worship and Education. His poems were the last and probably the most perfect lyric expression of German Romanticism; some, especially *In einem kühlen Grunde*, reaching the popularity of the *Volkslied*. His later poetic work is generally cast in narrative form (*Julian*, 1853; *Lucius*, 1857) and is tinged with increasing clerical views. His admirable translations from the Spanish, *Der Graf Lucanor* (1845) and *Die geistlichen Schauspiele Calderons* (2 vols., 1846–53), were prompted by the same tendency. His most famous prose work is the familiar tale *Aus dem Leben eines Taugenichts* (1826), which retains its popularity throughout Germany. Mention should also be made of a series of literary critiques, beginning with *Ueber die ethische und religiöse Bedeutung der neuen romantischen Poesie in Deutschland* (1847); *Geschichte der poetischen Litteratur Deutschlands* (1857). A collective edition of his poems appeared in 1841–43 (3d ed., 1883), and a selection of his miscellaneous works in 1867 (5 vols.). Consult the study by Keiter (Cologne, 1887), and Krüger, *Der junge Eichendorff* (Opeln, 1898).

**EICHHORN**, ik'hörn, JOHANN GOTTFRIED



(1752-1827). A German historian, theologian, and Orientalist. He was born at Dürrenzimmern, Oct. 16, 1752, and studied at Göttingen. In 1775 he became professor of Oriental languages at Jena and in 1788 at Göttingen. Eichhorn's scholarship was very broad and profound, but he is chiefly remembered at the present time as a biblical critic and a leader of the rational school. He first called the attention of German scholars to Astruc's discovery respecting the names for God in the Pentateuch, from which have developed modern ideas of its origin, and adopted the theory that the synoptic Gospels derive their story from one common source (*Urevangelium*). His *Introductions to the Old and the New Testament* were the first purely literary historical treatment of the biblical writings. Other noteworthy works are: *Urgeschichte* (1790-93); *Einleitung in die apokryphischen Bücher des alten Testaments* (1795); *Uebersicht der französischen Revolution* (1797); *Geschichte der drei letzten Jahrhunderte* (1817); *Weltgeschichte* (1818-20). From 1812 he edited the *Göttingen Gelehrte Anzeigen*. Consult Cheyne, *Founders of Old Testament Criticism* (New York, 1893).

**EICHHORN, KARL FRIEDRICH** (1781-1854). A German jurist and author, born at Jena and educated at Göttingen. He successively occupied the chair of law at Frankfort-on-the-Oder (1805-11), Berlin (1811-17), Göttingen (1817-28), and Berlin (1832-34). He also filled several important positions in a judicial capacity under the Prussian government. The principal works of Eichhorn, who may rightly be called the founder of the historical school of German jurisprudence, are the following: *Deutsche Staats- und Rechtsgeschichte* (1808-23; 5th ed., 4 vols., 1843-44); *Einleitung in das deutsche Privatrecht mit Einschluss des Lehnrechts* (1823; 5th ed., 1845); *Grundsätze des Kirchenrechts* (2 vols., 1821-23; Fr. trans. by H. Jouffroy, 1843).

**EICHHORST, IK'hörst, HERMANN LUDWIG** (1849- ). A German physician, born and educated at Königsberg. In 1877 he was appointed director of the Medical Polyclinical Institute at Göttingen. In 1884 he became professor of pathology and therapy at the University of Zurich. He is the author of the following important works: *Lehrbuch der physikalischen Untersuchungsmethoden innerer Krankheiten* (3d ed., 1889); *Handbuch der speziellen Pathologie und Therapie* (5th ed., 1895-96); *Handbuch der speziellen Pathologie und Therapie innerer Krankheiten* (1904); *Hygiene des Herzens und der Blutgefäße im Gesunden und Kranken Zustände* (1906); *Pathologie und Therapie der Nervenkrankheiten* (1907).

**EICHLER, IK'lër, AUGUST WILHELM** (1839-87). A German botanist. He was born at Neukirchen and was educated at Marburg. In 1871 he became professor of botany and director of the Botanical Garden at Graz, whence he was called to the chair of botany at Kiel (1873) and Berlin (1878). Very valuable are his writings on the Coniferae, Cycadaceae, and other plant groups of Brazil. His principal work, *Blütendiagramme* (2 parts, 1875-78), advocates and describes the comparative study of the structure of flowers. His other publications include: *Syllabus der Vorlesungen über spezielle und medizinisch-pharmazeutische Botanik* (1883), in which groups of families (orders) are defined; *Beiträge zur Morphologie und Systematik der*

*Marantaceen* (1884); *Zur Entwicklungsgeschichte der Palmenblätter* (1885).

**EICHRODT, IK'rôt, LUDWIG** (1827-92). A German jurist and humorous poet, born at Durlach and educated at Heidelberg. His cycle of songs, entitled *Wanderlust*, published by him in the *Fliegende Blätter* at the age of 21, established his popularity as a humorist. In 1848 he founded, at Frankfort-on-the-Main, the humorous-satirical periodical, the *Satyr*. Eichrodt wrote a number of works chiefly distinguished for their parody, such as *Gedichte in allerlei Humoren* (published in 1853 under the pseudonym of Rudolph Rodt; 3d ed. under the title *Lyrische Karikaturen*, 1869); *Rheinschwäbische Gedichte in mittelbadischer Sprechweise* (2d ed., 1873); *Lyrischer Kehraus* (2d ed., 1870). Eichrodt's collected poems, *Gesammelte Dichtungen* (Stuttgart, 1890), contain the well-known *Juvallera*, a cycle of modern student songs. Consult Kennel, *Ludwig Eichrodt: Ein Dichterleben* (1895).

**EICHSTÄDT, IK'stët, HEINRICH KARL ABRAHAM** (1772-1848). A German philologist, born at Oschatz. He was appointed professor of philosophy at Leipzig in 1795 and of eloquence and poetry at Jena in 1803. He wrote Latin fluently and elegantly. He was a friend of Goethe, in whose honor he wrote the *Oratio Goethii Memoriae Dicata* (1832). He also published editions of the classics and a translation (1802-08) of Mitford's *History of Greece*. Consult *Goethes Briefe an Eichstädt*, ed. by Biedermann (Berlin, 1872).

**EICHSTÄTT, IK'stët.** A town of Bavaria, situated on the left bank of the Altmühl, about 14 miles northwest of Ingolstadt (Map: Germany, D 4). Its cathedral, begun in the eleventh century, contains some fine stained glass, mural paintings, the tomb of St. Wilibald, and a number of monuments in bronze and marble. The church of St. Walpurgis contains relics of that saint and is visited by pilgrims on May 1, Walpurgis Day. The town hall, dating from 1444, and the old Leuchtenberg Palace of the prince bishops, now used as barracks, are also noteworthy. Eichstätt has also an episcopal lyceum, a theological school, a classical school, and a municipal theatre. It produces beer, lithographic stones, matches, and shoes. The ancient city is supposed to have had its origin in a Roman station. It obtained municipal privileges in 908, when its walls were built, suffered greatly during the Thirty Years' War, and was burned several times by the French during the eighteenth and nineteenth centuries. Pop., 1910, 8029. The bishopric of Eichstätt, founded in 745, was secularized in 1802 and annexed to Bavaria, but a new bishopric was organized in accordance with the agreement of 1817 between Bavaria and the Vatican.

**EICHTHAL, äsh'täl', GUSTAVE D'** (1804-86). A French publicist, born at Nancy. He was a pupil of Comte, a disciple of Saint-Simon, and a collaborator on the *Organisateur* and the *Globe*. To avoid the attacks upon Saint-Simonism he went to Greece, where he became interested in the rehabilitation of the country, which had been ruined by the War for Independence. His efforts were unappreciated by the Greeks, and he returned to France and gave himself up to authorship. His works include: *Une histoire primitive des races océaniques et américaines* (1845) and *Les origines bouddhiques, de la civilisation*

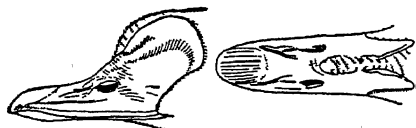
sation américaine (1864-65). Some of his essays on biblical criticism were collected and published by his son under the titles *Mélange de critique biblique* (1886) and *La théologie et doctrine religieuse de Socrate* (1881).

**EICHWALD, IK'VÄLT, EDUARD GEORG** (1838-89). A Russian physician, son of Karl Eduard Eichwald, born at Vilna and educated at the Medico-Surgical Academy at St. Petersburg. He was physician in ordinary from 1865 to 1875 to the Grand Duchess Helena Pavlovna, who made him the legatee of a sum which enabled him to found the clinical institute subsequently named in honor of its patroness. In 1866 Eichwald was appointed professor of medical diagnosis and general therapy at the Medico-Surgical Academy, and in 1883 he became professor at St. Petersburg. His works, published chiefly in German, include: *Die Kolloidentartung der Eierstöcke* (1864); *Beiträge zur Chemie der gewebebildenden Substanzen* (1873); and a treatise on general therapeutics in Russia (5th ed. by G. Schapiro, 1892).

**EICHWALD, KARL EDUARD** (1795-1876). A Russian naturalist and traveler, born in Mitau. He studied medicine and the natural sciences at Berlin, Vilna, and Dorpat, and became professor of zoölogy and obstetrics at Kazan in 1823, professor of zoölogy and comparative anatomy at Vilna in 1827, and professor of zoölogy and mineralogy at St. Petersburg in 1838. He traveled extensively for scientific purposes in eastern and northern Russia, in the Caucasus, Persia, Algeria, and throughout Europe. Among his works are: *Zoologia Specialis* (1829-31); *Fauna Caspio-Caucasia* (1841); *Die Urvwelt Russlands* (1840-47); *Die Paläontologie von Russland* (1851).

**EIDER, I'dér.** A river of Schleswig-Holstein, Prussia, rising about 10 miles south of Kiel. It is the outlet of the small Lake Redden and flows first northwest, then in a generally westward direction, entering the North Sea at Tönning, its total length being 115 miles (Map: Germany, C 1). In the lower part of its course it is from 600 feet to 1000 feet wide, with a depth of 15 to 18 feet; below Tönning the river expands into a bay. It is navigable from its mouth as far as Rendsburg, from which town navigation is carried on to Kiel by the Schleswig-Holstein Canal, which, prior to the construction of the Kaiser Wilhelm Canal, was the only artificial waterway connecting the North Sea with the Baltic.

**EIDER** (Icel. æpr, eider). An oceanic duck, having the hind toe furnished with a deep lobe and a bill swollen and elevated at the base



BEAK OF KING EIDER.

Side and top views of the bill of *Somateria spectabilis*.

and extending up the forehead, where it is divided down the middle by an elongated projection of feathers. The tertials are elongated and fall down over the wing. The genus is further characterized by the very abundant development of a fine elastic gray down, particularly on the breast, the valuable eider down of commerce.

Several species are known, grouped into three

genera. The best known and most important is the American eider (*Somateria molissima*), which is intermediate in size between a common duck and a goose. The male is larger than the female and in the breeding season has the under parts black, the upper parts creamy white. The female is pale brown, tinged with red, and varied with transverse marks of dark brown. Young males at first resemble the females and do not acquire the full adult plumage and begin to mate and breed until their third year. The eider is an inhabitant of the northern parts of the world, occurring on Arctic and Subarctic shores and in suitable localities from Spitzbergen to the Feroe Islands, off the northeast coast of England, where it is known as the St. Cuthbert duck. It is also numerous in southern Greenland; and the shores of Alaska and Siberia are inhabited by a very similar species (*Somateria v-nigra*). All these descend to middle latitudes in winter. Two other distinctively American species of the genus exist. One is the American eider (*Somateria dresseri*), which differs from the European bird (drake) mainly in having a black instead of an obscure green patch on the crown and in the shape of the bill (see Plate of NORTH AMERICAN WILD DUCKS in article DUCK); the other is the king eider (*Somateria spectabilis*), which has a v-shaped black mark on the throat. Both breed on the coasts of Newfoundland and Labrador, and the latter goes also to the extreme North, where it is widespread. Both are favorites with sportsmen when they come south in winter along the coast as far as the Middle States and inland to the Great Lakes. Two other species are known—Steller's eider (*Polyicta stelleri*), which is abundant on the Arctic shores of Europe, Asia, and northwestern America; and the spectacled eider (*Arctonetta fischeri*), which seems to be confined to the northwest coast of America. The now extinct Labrador duck was nearly related to them.

**Eider Down.** The down from the breast of an eider and taken from its nest or from the body of a dead bird for commercial use. The eiders nestle upon coasts, seeking nooks and crannies in which to hide their treasures. As is the habit of many ducks, the mother begins, as soon as the eggs come, to pluck the easily removed down from her breast with which to cover them during her absences, thus both blanketing and concealing them. This down is mouse gray and of the exquisitely soft texture which makes it so valuable. Formerly, as still in Greenland, which furnishes perhaps the largest part of the down sent to market, the down was taken from the wild nests found on coasts. Gradually a certain measure of protection was introduced in some European countries. The next movement was to dig a great number of convenient little hollows or chambers in the soil and among the rocks of sea-fronting hills—accommodations which the ducks were quick to take advantage of. Many such eider folds exist in Norway and Iceland and are regarded as property. The eggs and down are quietly taken from each nest at intervals of a few days by the owners of the eider fold, until the limit of the bird's endurance has been reached, when she is permitted to hatch a few eggs, in order to maintain the race.

About half a pound of eider down is said to be obtained annually from each nest, but this is much reduced by cleaning. Down taken from

birds which have been killed is inferior in quality to that obtained from the nests. The latter is known in commerce as "live" down, the former as "dead" down. The elasticity of the down is such that three-quarters of an ounce of it will fill a large hat, while two or three pounds of it may be pressed into a ball and held in the hand. Its use is most extensive in Germany for stuffing bed coverings. For excellent accounts of these birds, consult: Millais, *British Diving Ducks* (London, 1913); Townsend, *A Labrador Spring* (Boston, 1910); id., "A Plea for the Conservation of the Eider," in the *Auk*, vol. xxxi (Cambridge, Mass., 1914).

**EIFFEL, Îfel, THE.** A bleak and barren plateau situated in the Rhine Province, in southwestern Prussia, between the Rhine on the east, the Roer on the west, and the Moselle on the south. It is in extent 40 miles by 20; the elevation averages from 1500 to 2000 feet, but an extreme altitude of nearly 2500 feet is reached. Its surface is diversified by depressions and ridges that show plainly its volcanic origin. The plateau belongs to the Devonian formation, and volcanic eruptions have brought near the surface in some portions a limestone that is particularly rich in fossils. Above this, in some parts, is found another formation, containing considerable quantities of zinc and lead. In the south colored sandstone adds variety to the scenery. In the lower valleys fruit and grain are cultivated, but above 1700 feet the climate is so raw that little grows besides heather. Grazing is extensively carried on.

**EIFFEL, a'fêl', ALEXANDRE GUSTAVE** (1832-). A French engineer, born at Dijon, Dec. 15, 1832, and educated at the Ecole Centrale. He constructed the iron bridge over the Garonne at Bordeaux in 1858 and later the lofty and graceful bridge over the Douro at Oporto; also the remarkable viaducts of Garabit in Cantal and of Montluçon; the frame on which Bartholdi's statue of "Liberty Enlightening the World" was built, and the celebrated Eiffel Tower (q.v.), on the completion of which he was made an officer of the Legion of Honor. He also prepared designs for the Panama Canal locks. In 1893 he was sentenced to fine and imprisonment for complicity in the Panama Canal frauds, but the sentence was annulled by the Court of Cassation. His later work was in connection with aerodynamics, and he maintained on the Champ de Mars a well-equipped laboratory for investigation and research, especially on air resistance, one feature of which is an air channel or tunnel in which the effect of air currents from power fans could be studied with immovable models. His *Resistance of the Air*, published in 1913 in an English translation, shows the effect of pressure on various supporting surfaces, the effects of the resistance of various parts of an aeroplane, and the efficiency of propellers. Eiffel's work at the time of its publication was the most systematic discussion of the problems of aerodynamics based on laboratory experiments since the classic researches of Langley in 1891 and afforded aeronautical engineers more accurate data than were ever available previously. See **AERONAUTICS**.

**EIFFEL TOWER.** A colossal structure erected in the Champ de Mars, at Paris, by the famous engineer, Alexandre Gustave Eiffel (q.v.). It was completed March 31, 1889, in time to serve as one of the notable features of the exposition of that year. The lower section of the

tower consists of four built-up iron columns, each of which consists of four smaller columns, resting on masonry piers and giving a supporting base 330 feet square. Around each of the four piers is a masonry wall 85 feet square and about 30 feet high, out of which the piers seem to spring. The four main columns curve towards each other until they unite in a single column, 620 feet above the ground. The piers are connected by arches some distance above the ground. There are platforms at the 189-feet, the 380-feet, and the 906-feet levels, which are reached by elevators as well as by stairs. Beyond the third platform a spiral staircase, which is not open to the public, ascends to the top of the tower, which is 984 feet (300 meters) above the ground. In each of the four piers there are elevators; but two of these run to the first platform only and the other two stop at the second platform. A third set of elevators runs between the second and third platforms, or 526 feet, one elevator making half the distance and the other the remainder. Each of these elevators may carry 63 persons. Otis elevators, American make, run from the ground to the second platform. On the first platform, which has a floor space of 38,000 square feet, or nearly an acre, there were four restaurants at the time of the exposition. Searchlights are mounted near the top of the tower, and here is a meteorological observatory, with physical and biological laboratories. The view from the Eiffel Tower extends to a distance of about 85 miles. In the construction of the tower some 7000 tons of iron were used; and the cost was estimated at considerably over \$1,000,000, of which about \$292,000 was voted by the government, while the remainder was supplied by M. Eiffel, who trusted for his reimbursement to the receipts from admission fees during the 20 years for which he is entitled to the profits of the tower. The profits for the year 1889 alone nearly paid for the cost of the tower. The Eiffel Tower more recently has played an important part in scientific research. From here have been suspended lofty antennæ used for wireless telegraphy, and the daily time signals under international agreement are sent out into space. Furthermore, in connection with aerodynamic and meteorological research, use has been made of the tower, and many problems involving wind pressure and currents have been studied.

**EIGENMANN, i'gen-mân, CARL H.** (1863-). An American zoölogist, born at Flehingen, Germany. He graduated in 1886 at Indiana University (Bloomington), studied at Harvard, and was connected with the biological laboratory at San Diego, Cal., and the marine biological laboratory at Woods Hole, Mass. In 1890, 1891, and 1892 he made scientific explorations in Dakota, Montana, Idaho, Oregon, California, and the western part of Canada for the British Museum. He was appointed professor of zoölogy at Indiana University in 1891 and founded there in 1895 a biological station of which he became director. He made scientific explorations in Cuba in 1902-04 and in British Guiana in 1908, and wrote: *Catalogue of Fresh-Water Fishes of Central America and Southern Mexico* (1893); *Cave Vertebrates of America* (1909); *Egg and Development of Conger Eel* (1901); *Fresh-Water Fishes of Western Cuba* (1908); *Fresh-Water Fishes of British Guiana* (1911).

**EIGG.** An island. See **EGG**, or **EIGG**.

**EIGHTH NERVE.** See **AUDITORY NERVE**.

**EIGHT-HOUR DAY.** The eight-hour day as the ideal working day was proposed in England as early as 1833. A trade-union congress at Birmingham demanded in 1869 that the eight-hour day should be adopted in the United Kingdom. With the growth of the Democratic Federation in the early eighties, the eight-hour agitation became general. The Socialists sought to secure the desired results through legislation, the trade-unions through combined action against individual employers. The trade-unions, however, have gradually come to look with more favor upon legislation looking towards the general establishment of an eight-hour day. The eight-hour day has been adopted by some British municipalities and also for certain classes of work in the government naval shops. In 1866 the National Labor Union of the United States demanded it. Eight-hour leagues were formed during the strike of 1872-73. The first law affecting national government employees was passed in 1869 and put into effect in the navy yards. The eight-hour day is now in force for all government work. The eight-hour day on public work conducted directly by the municipalities is now nearly universal in the United States. In many of the States work on public contracts must also be conducted under the eight-hour system, and in 1912 Congress enacted an eight-hour law for contract work for the Federal government, admitting, however, of certain minor exceptions. An instance of the tendency to extend the influence of the governmental eight-hour system over private industry appears in a provision of the Naval Appropriations Law of 1911: no part of the appropriations made for submarine boats was to be expended for their construction by any person, firm, or corporation which had not at the time of the appropriation extended the eight-hour day to all laborers doing such work.

Even more significant has been the recent tendency, especially in evidence in the Rocky Mountain States, to fix an eight-hour day for workers in various private employments. In Colorado the eight-hour law applies to underground mines and workings, open-pit workings, smelters, reduction works, concentrating mills, and practically all other operations connected with the metal-mining industry. The constitution of Idaho prescribes an eight-hour day for similar work. In Montana an eight-hour day is prescribed by law for underground mines or workings, including railway tunnels. In Nevada the eight-hour day is prescribed not only for underground work in mines, but also for surface work above mines as well as for that of carpenters and other mechanics employed in connection with such work. In Arizona the eight-hour day is prescribed for mines and smelters and similar works. In Pennsylvania the hours of hoisting engineers in mines are restricted to eight. In Missouri the eight-hour day is prescribed by law for silica mining and plate-glass manufacturing; in Louisiana, for stationary firemen.

In 1911 California and Oregon enacted eight-hour laws for women employed in a wide range of occupations. These laws were upheld by the State Supreme Courts, and the Oregon law by the Federal Supreme Court. In 1913 Arizona and Colorado enacted laws restricting women's labor to eight hours. Massachusetts in 1913 enacted a law fixing a limit of eight hours for children under 16 in factories and workshops.

Parallel with the extension of the eight-hour system through legal enactment has been its extension through trade-union activity and through action of private employers. The eight-hour day is widely in force in the building and printing trades, in coal mining, and in certain branches of the metallurgical industries. No statistics are available showing the full extent to which the eight-hour day has been achieved. But it can no longer be held to be exceptional in American industry. In England the mining and metallurgical industries are to a large extent under the eight-hour system, as are also the building trades and a large range of other skilled trades. Unionism has been more largely responsible for the establishment of an eight-hour day in England than in any other country.

On the continent of Europe a widespread agitation in favor of an eight-hour day developed in the last quarter of the nineteenth century. Since 1880 the demand for an eight-hour day has formed a part of the powerful labor parties of France and of the Social Democratic party in Germany. The Continental labor organizations and political parties favor the enactment of laws reducing the working day to eight hours. Through the support of the present German Emperor the movement has attained some positive results in Germany. The eight-hour day has been established in some of the industrial enterprises of the government and in a few trades.

In Australia the movement has made greater headway than in any other country. Public sentiment is strongly in favor of a legal eight-hour day. As early as 1856 the stronger trades in Melbourne were able to enforce an eight-hour day, and the movement rapidly spread to the smaller cities of Victoria and to the other colonies. In the Colony of Victoria the hours of women working in factories were in 1874 limited to eight; in 1885 the same restriction was extended to all employments of women and boys. The eight-hour day was in 1877 prescribed by law for all men working underground; and it has been extended to men employed on many public and quasi-public works. See **LABOR, AMERICAN FEDERATION OF; LABOR PROBLEMS; TRADE-UNIONS**. Consult: Rae, *Eight Hours for Work* (New York, 1894); Hedfield and Gibbins, *A Shorter Working Day* (London, 1894); Robertson, *The Eight-Hour Question* (ib., 1899); National Association of Manufacturers, *Eight Hours by Act of Congress* (New York, 1904); *Labor Laws of the United States* (Washington, 1904); Bureau of Labor, *Nineteenth Annual Report: Wages and Hours of Labor* (ib., 1905); House Committee on Labor, *Eight Hours for Laborers on Government Work* (ib., 1906); *Review of Legislation of American Association for Labor Legislation* (1911).

**EIKON BASILIKE**, *ēkōn bā-sīl'ī-kē* (Gk. *eikōn basilikē*, kingly likeness). The name of a book, the full title of which is **EIKON BASILIKH, The Pourtraiture of His Sacred Majesty in His Solitudes and Sufferings** (1648). It was published probably at The Hague and, appearing immediately after the execution of Charles I, professed to be from his Majesty's pen. Milton, in the *Iconoclastes* (1649), assailed it, suggesting doubts also as to its genuineness. The Royalists, on the other hand, warmly defended the theory of royal authorship; but after the Restoration John Gauden, Bishop of Exeter, asked for pro-

motion to the bishopric of Worcester on the ground that he had himself written the book. It is an important fact that the Royalist Clarendon, author of the *History of the Rebellion*, at once accepted this unpalatable statement of the matter. As others, however, refused to credit Gauden, the controversy has raged to the present day. If Gauden was the author, as most authorities now believe, he must have entered thoroughly into the spirit of Charles, though he necessarily idealized the King's character. Consult especially: Wordsworth, *Who Wrote Eikōn Basilikē?* (Cambridge, 1824); Todd, *Bishop Gauden the Author of Icōn Basilike, Further Shown in Answer to the Recent Remarks of Rev. Dr. Wordsworth* (London, 1825); Toland, *Amyntor* (ib., 1699); Tuckerman, *On the Author of Eikōn Basilikē* (Berlin, 1874); Godwin, *History of the Commonwealth*, vol. ii, pp. 684 ff. (London, 1826); Hallam, *Constitutional History of England*, vol. ii, pp. 313 f., 636-642 (ib., 1828); Almack, *Bibliography of the King's Book, or Eikon Basilike* (ib., 1896), very valuable. See GAUDEN, JOHN.

**EILDON** (ēl'don) **HILLS**. Three peaks in Roxburghshire, Scotland, near Melrose, of traditional interest and celebrated for the extensive view from their summits (Map: Scotland, F 4). The highest is 1385 feet.

**EILEEN AROON**. See ROBIN ADAIR.

**EILEITHYIA** (Lat., from Gk. *Ειλειθυια*), or **EILEITHYASPOLIS**. The Greek name of the ancient Egyptian city of Nekheb (the modern El-Kab), situated on the right bank of the Nile, a little below Edfu (Map: Egypt, C 2). From very ancient times it was one of the most important cities of Egypt and was strongly fortified. Its ancient walls still exist in an excellent state of preservation. In Ptolemaic times the city was the capital of the Third Nome of Upper Egypt. The princes of Nekheb played a very important part politically, and many of them were governors of Nubia. The local deity, Nekhet, was the tutelary goddess of Upper Egypt and the special patroness of the King. She was supposed to preside over birth and was therefore identified by the Greeks with Eileithyia (whence the Greek name of the city) and by the Romans with Lucina. Nekhet is represented as a vulture with outspread wings, as a woman wearing the crown of Upper Egypt, or as a winged uræus serpent. Near the remains of the ancient city are the ruins of a temple built under Rameses II by Setaw, Governor of Nubia; of another built by Amenophis III and dedicated to the local goddess; and of a third temple built in late Ptolemaic times and likewise dedicated to Nekhet. All three temples are richly decorated and contain numerous inscriptions. The most important remains at El-Kab are, however, the rock-hewn tombs. Among them are the tomb of the admiral Aahmes, who took part in the expulsion of the Hyksos (q.v.) from Egypt; that of his namesake and younger contemporary, the general Aahmes (Pen-necheb); and that of the nomarch Paheri, tutor to Prince Nazmes, son of King Amenophis I. The two former tombs especially contain inscriptions of the highest historical value. Consult: Wilkinson, *Modern Egypt*, vol. ii (London, 1843); Champollion, *Notices descriptives* (Paris, 1844); Brugsch, *Reiseberichte aus Aegypten* (Leipzig, 1855); Tylor and Griffith, "The Tomb of Paheri at El-Kab," *Egyptian Exploration Fund Memoirs*, vol. xi (London, 1894); Quibell, *El Kab* (ib., 1897).

**EILENBURG**, il'en-bōōrk (anciently called *Ilburg*). A town of the Prussian Province of Saxony, situated mainly on an island in the river Mulde, about 15 miles northeast of Leipzig (Map: Germany, E 3). It has large manufactures of calico, yarn, cloth, dyestuffs, vehicles, basketwork, tobacco, chemicals, celluloid, beer, and agricultural implements. Franz Abt the song writer and M. Rinckart the poet were born here. Pop., 1900, 15,147; 1910, 17,401. Consult Gundermann, *Chronik der Stadt Eilenburg* (Eilenburg, 1879).

**EIMBECK**. See EINBECK.

**EIMBECK**, im'bēk, WILLIAM (1841- ). An American geodesist, born in Brunswick, Germany. He was an assistant civil engineer in the public offices of St. Louis, Mo., a professor for two years in W. . . . University, St. Louis, and a member . . . States solar eclipse expeditions of 1869 (to Illinois) and 1870 (to Italy). After 1871 he was an assistant on the United States Coast and Geodetic Survey. His most important work was in connection with the thirty-ninth parallel . . . (Western division) and with the . . . invariable reversible pendulum and the duplex base apparatus employed in the Geodetic Survey.

**EIMEO**. See MOOREA.

**EIMER**, i'mēr, THEODOR (1843-98). A Swiss-German zoölogist, born in Stäfa. He studied medicine and the natural sciences in Heidelberg, Würzburg, Freiburg, and Berlin. In 1870 he became privatdocent in Würzburg and in 1875 professor of zoölogy in Tübingen. In 1878-79 he made a scientific journey to Egypt. He wrote: *Zoologische Studien auf Capri: Beroë Ovatus und Lacerta Muralis Cœrulea* (1874); *Die Medusen* (1879); *Untersuchungen über das Variieren der Mauereide* . . . ; *Die Entstehung der Arten auf Grund der Vererbung erworbener Eigenschaften* (1888; 1897); *Artbildung und Verwandtschaft bei den Schmetterlingen* (1889; 1895).

**EIMÉRICO**, NICOLÁS. See EYMERICUS, NICOLAS.

**EINBECK**, in'bēk, or **EIMBECK**. An old town in the Prussian Province of Hanover, on the Ilme, about 40 miles south-southeast of Hanover (Map: Germany, C 2). The Alexanderkirche contains the tombs of the princes of Grubenhagen, a fine bronze baptismal font, and some old choir chairs. Its schools teach technical subjects such as machinery construction and weaving; it has also a police school. Its manufactures include belts, linen, carpets, sugar, tobacco, and roofing felt. The famous Eimbecker beer, which has given its name to the well-known term "bock," is still brewed to a considerable extent. Pop., 1900, 7914; 1910, 9431. Einbeck grew up around a cathedral chapel reputed to contain the blood of the Saviour and visited by throngs of pilgrims. It was a member of the Hanseatic League, but in 1626 was captured by Pappenheim, in 1641 by Piccolomini, and in 1761 by the French, who dismantled its fortifications. Consult H. L. Harland, *Geschichte der Stadt Einbeck*, vol. ii (Einbeck, 1854-59).

**EINHARD**, or **EINHART**, in'härt, frequently called **EGINHARD**, a'gin-härt (c.770-840). The biographer of Charles the Great. He received his early education in the monastery of Fulda, where he did so well that he was sent to the school in the palace of Charles the Great. His talents and acquirements gained

him the favor of the Emperor, who appointed him his private secretary and superintendent of public buildings. In 806 he was dispatched by Charles on a mission to Pope Leo III. On the death of the Emperor he was appointed by Louis the Pious abbot of various monasteries, but ultimately he retired to the town of Mühlheim. Here he erected a monastery, which caused the name to be changed from Mühlheim to Seligenstadt (City of the Blessed). Einhard died on March 14, 840, and was buried beside his wife, who died in 836. The two coffins are now shown in the chapel of the castle at Erbach. The counts of Erbach trace their descent from Einhard. His *Vita Caroli Magni*, completed about the year 820, in respect to plan, execution, language, and style, is incontestably the most important historical work of a biographical character that has come down to us from the Middle Ages. It was frequently used as a school-book and was therefore copied *ad infinitum*. His *Epistolæ* are also of great value for the history of the later years of Louis the Pious. Einhard also wrote an account of the translation of the relics of Saints Marcellinus and Peter from Rome to Seligenstadt. To Einhard also are ascribed the so-called *Annals of Einhard* and a rhythmical *Passion of the Martyrs Marcellinus and Peter*. According to the later Middle Ages, Einhard's daughter was a daughter of Charlemagne. Love had arisen between them, and on one occasion, when the two had clandestinely met at night in Emma's chamber, a sudden fall of snow covered the spacious court, thus rendering retreat impossible without leading to discovery. As the traces of feminine footsteps could not excite suspicion, Emma carried her lover across the court on her shoulders. This scene, it is said, was observed from a window by Charlemagne, who united the pair in marriage. On this legend Fouqué founded his romance of *Eginhard und Emma*, and Longfellow has made it the subject of a short poem. For the editions of Einhard's works and for special studies, consult Wattenbach, *Deutschlands Geschichtsquellen*, vol. i (Berlin, 7th ed., Stuttgart, 1904), and Molinier, *Les sources de l'histoire de France*, vol. i (Paris, 1902).

**EINSIEDELN**, in'zè-dèln. A town in the Canton of Schwyz, Switzerland, 2895 feet above sea level, and 26 miles southeast of Zurich. It is one of the most famous pilgrim resorts in the world, being visited yearly by 160,000 transients, most of whom come from Switzerland and southern Germany (Map: Switzerland, C 1). There are numerous hotels and inns for the worshippers. The principal industry is the manufacture of images of saints, crucifixes, and other devotional objects that are exported to all parts of the world. The road up to the celebrated Benedictine monastery of Einsiedeln, which is 2900 feet above the village, passes the house where Paracelsus (q.v.) is said to have been born. The monastery buildings, in the midst of a gloomy forest that was once extensive, and surrounded by a quadrangle of walls, were six times partially or entirely destroyed by fire before the seventeenth century. In 1704-19 they were rebuilt in the Italian style. At the entrance of the church are statues of the emperors Otto I and Henry II. In a large court is a black marble fountain with 14 jets, surmounted by a statue of the Virgin, from which pilgrims drink. In the nave is the black marble chapel containing the renowned miracle-working image

of the Virgin, richly bedecked and bejeweled. This is the "sanctum sanctorum" of the pilgrims. The gorgeous chandelier was given by Napoleon III in memory of his mother. The monastery has a library of 61,800 volumes and 1200 manuscripts, a seminary, a gymnasium, and a lyceum. It owes its origin to the hermit Meinrad, who erected a chapel for the image of the Virgin which had been given him by the Abbess Hildegard, and which has made Einsiedeln one of the most famous of Catholic pilgrimages. The founder of the monastery was Eberhard, provost of Strassburg, who began the building in 934. Pop., 1900, 8469; 1910, 8438. The vicinity affords fine views of the Alps and the Lake of Lucerne. Consult Brandes, *Die Feier des tausendjährigen Bestehens von Maria Einsiedeln* (Einsiedeln, 1862), and O. Ringholtz, *Geschichte des fürstlichen Benediktinerstiftes Einsiedeln*, vol. i (ib., 1904).

**EIRE, JUSTICES IN.** See EYRE, JUSTICES IN.

**EISELEN**, íze-len, ERNST WILHELM BERNHARD (1793-1846). A German promoter of athletic exercise, born in Berlin. He established the terms still used in German fencing. In 1818 he opened a public gymnasium in Berlin, which was followed in 1832 by one especially designed for the gymnastic training of girls. He was one of the foremost promoters of those athletic exercises which have directly and indirectly contributed to the physical improvement of the Germans, becoming bases of military training and conducing to the splendid successes achieved by the German arms during the nineteenth century. It is interesting to note that it was largely from these transplanted gymnasia, or *Turnvereine*, that some of the best German volunteers of the Civil War in the United States were recruited. The literary productions of Eiselen include: *Deutsche Turnkunst*, in association with Jahn (1816); *Hantelübungen* (1833; 3d ed., 1883); *Abbildungen von Turnübungen* (1845; 5th ed., 1889); *Das deutsche Hiebfechten* (1818; new ed., 1882); *Abriß des deutschen Stossfechtens* (1826; new ed., 1889).

**EISENACH**, íze-nàc. A town and summer resort of the Grand Duchy of Saxe-Weimar, and former capital of the Principality of Saxe-Eisenach, situated at the northwest end of the Thuringian Forest, where the Nesse meets the Hörsel, 32 miles west of Erfurt (Map: Germany, D 3). The town is well laid out, with a number of beautiful squares, one of which, the Lutherplatz, contains the house where Luther lived while studying at Eisenach, and another, Karlsplatz, is adorned with a bronze statue of Luther. The most noteworthy ecclesiastical edifices are the church of St. Nicholas, dating from the twelfth century, with an octagonal tower; the church of St. George, a large Gothic edifice with a bronze statue of Sebastian Bach, a native of Eisenach. Other interesting buildings are the palace, erected in 1742, once residence of the Duchess Hélène of Orléans; the town hall; the Klemnda, a small castle dating from the thirteenth century; the theatre; the house where Bach was born and another where Fritz Reuter lived. Not far from the town, on a lofty eminence, is the castle of Wartburg, the residence of the mediæval landgraves of Thuringia, dating probably from the eleventh century and restored. It consists of two main parts, the Vorburg and the Hofburg—the former containing the Ritterhaus and stables and the latter the apartments of the landgraves. In



one of the rooms of the Vorburg, Luther worked on his famous translation of the Bible. The Hofburg contains many halls of great splendor, including the Singersaal, where, according to local tradition, the contests of the Minnesingers were held under the patronage of the Landgrave Hermann I (1190-1217), as described in the old poem *Krieg von Wartburg*. The castle is now occasionally occupied by the Grand Duke of Weimar.

Among the educational institutions of Eisenach, the most prominent is the gymnasium, formerly a Latin school, which Luther and Bach once attended, a school of forestry, a school of design, and a teachers' seminary. Eisenach has some well-developed manufacturing industries and produces paint, chemicals, woolen goods, leather, pottery, shoes, tobacco, cigars, cement, pipe, alabaster ware, cabinetwork, and lumber. The neighborhood is remarkably picturesque, being ornamented with splendid gardens and residences. The town was founded in 1070, near the older town of Isenach, or Isenacum. It prospered under the protection of the landgraves of Thuringia, the owners of the Wartburg, and was from 1596 to 1741 the residence of the princes of Eisenach. Pop., 1900, 31,442; 1910, 38,362. Consult: Storch, *Beschreibung der Stadt Eisenach* (Eisenach, 1831); Schwerdt and Jäger, *Eisenach und die Wartburg* (ib., 1871); Warnatz, *Die Wartburg und Eisenach in Sage und Geschichte* (Vienna, 1881); Scheller, *Eisenach und Umgebung*, ed. by Kühner (Eisenach, 1898).

**EISENACH CHURCH CONFERENCE**, or EVANGELICAL CHURCH CONFERENCE. The name given to periodical meetings of representatives of the Protestant churches of the German states and Austria. The first was held at Berlin in 1846 and included representatives from nearly all the German states; the second at Eisenach, in 1852; and since 1854 they have been held every two years at the latter place. The aim is the discussion of questions of general interest and the promotion of unity among the individual churches. Since 1852 the conference has published at Stuttgart a central organ, the *Allgemeine Kirchenblatt für das evangelische Deutschland*. Consult Braun, *Zur Frage der engern Vereinigung der Deutschen evangelischen Landeskirchen* (Berlin, 1902).

**EISENBERG**, *īzen-bĕrk*. An old town in the Duchy of Saxe-Altenburg, Germany, near the junction of the Saale and Elster, 36 miles southwest of Leipzig. It contains a ducal palace, with a fine church and gardens, and manufactures woolens, velvet, pottery, furniture, pianos, porcelain, and agricultural machines. Statues have been erected to Bismarck, Duke Christian of Saxe-Eisenberg, and the philosopher Karl Christian Friedrich Krause. Pop., 1900, 8764; 1905, 9956; 1910, 10,749. Consult *Chronik der Stadt und des Amtes Eisenberg* (Eisenberg, 1843).

**EISENERZ**, *īzen-ĕrts*. A market town of Styria, Austria, 2350 feet above sea level, on the Erzbach, 24 miles northwest of Leoben (Map: Austria, D. 3). The Gothic church of St. Oswald, founded in 1279, is an excellent example of the fortified type of ecclesiastical architecture. The town derives its importance from its proximity to the Erzberg, a mountain about 5000 feet high, containing valuable deposits of iron ore. About 4500 miners are employed in the quarries on the mountain in summer and 2800 in winter, the annual output being about 1,000,-

000 tons, of which about 40 per cent is metal. Aragonite (*Eisenblüte*, or *flos ferri*), resembling branching coral in form and of the most beautiful and purest white, is found in grottoes in the interior of the mountain. Pop., 1890, 5700; 1900, 6494.

**EISENHART**, *īzen-härt*, LUTHER PFAHLER (1876- ). An American mathematician, born at York, Pa. He graduated from Gettysburg College in 1896, took the degree of Ph.D. at Johns Hopkins University four years later, was instructor and preceptor at Princeton University from 1900 to 1909 and thereafter professor of mathematics. In 1913-14 he was a vice president of the American Mathematical Society. Besides contributions to journals, he is author of *Differential Geometry* (1909).

**EISENLOHR**, *īzen-lör*, AUGUST (1832-1902). A German Egyptologist, born in Mannheim. He studied theology at Heidelberg and Göttingen and later became interested in the natural sciences and the manufacture of chemical products, abandoning both, however, for the study of Egyptology. In 1872 he was made an extraordinary, and in 1885 full, professor at Heidelberg University. His chief works are: *Der grosse Papyrus Harris* (Leipzig, 1872); "The Political Condition of Egypt before the Reign of Rameses III," in the *Transactions of the Society of Biblical Archaeology* (London, 1872); *Ein mathematisches Handbuch der alten Aegypter* (Rhind papyrus of the British Museum, trans. with explanatory notes, Leipzig, 1877).

**EISENLOHR**, THEODOR (1805-69). A German divine and educator. He was born at Herrenberg and studied theology at Tübingen. After holding several pastorates and conducting the seminary at Nürtingen, Württemberg, he became a member of the Diet of Württemberg and a counselor of the Board of Public Instruction in that city. He was editor of the departments of ecclesiastical and educational law in Reyscher's *Sammlung der württembergischen Gesetze*, vols. viii, ix, and xi (1834-39), and published *Das Volk Israel unter der Herrschaft der Könige* (2 vols., 1855-56), in which he endeavors to show the great importance of biblical history as an educational factor, and *Die Idee der Volksschule nach der Schriften Fr. Schleiermachers* (1852).

**EISENLOHR**, WILHELM (1799-1872). A German physicist, born at Pforzheim. He studied mathematics and physics at Heidelberg and became professor of physics at the Polytechnical Institute at Karlsruhe in 1840. He established the first industrial school of Baden, at Mannheim, and assisted in the organization of all similar institutions afterward erected in that grand duchy. His principal publication is the popular textbook entitled *Lehrbuch der Physik* (1836; 11th ed., 1876).

**EISENMENGER**, *īzen-mĕng'ĕr*, AUGUST (1830- ). An Austrian mural painter, born in Vienna. He studied at the Vienna Academy (1845-48) and in 1856 became the pupil and assistant of Rahl. From 1872 to 1901 he was a professor in the Academy. His more important works include the frieze medallions in the Museum of Art and Industry, Vienna; a series of historical pictures illustrative of the reign of Emperor Maximilian I, in Castle Hörtstein, near Vienna (1872-79); and the decorative painting in the session room of the Chamber of Deputies in the Reichsrat building at Vienna (1885).



**EISENMENGER**, JOHANN ANDREAS (1654-1704). A German Hebraist and anti-Semitic writer, born at Mannheim. Because of his scholarly achievements while a student of Hebrew at the Collegium Sapientiae in Heidelberg, he was sent to England and Holland by Charles Louis, Elector of the Palatinate. He spent some time in Amsterdam and subsequently devoted himself for many years in Heidelberg, and, after the capture of this city in 1693, at Frankfurt, to the study of Hebrew literature. He was appointed professor at Heidelberg by the Elector, John William, in 1700. His principal work was entitled *Entdecktes Judenthum*. It was first published at Frankfurt in 1700, but was confiscated by the Emperor, who ordered the whole edition to be placed under lock and key. Eisenmenger died suddenly of apoplexy in 1704. King Frederick William I of Prussia ordered a new edition to be printed in Berlin, which appeared in 1711, giving Königsberg as the place of printing, as the Imperial prohibition applied to Berlin. It was compiled from nearly 200 Hebrew and about 12 Judæo-German sources and included material drawn from books written by converted Jews. Delitzsch has shown the many inaccuracies of translation in this work, and Siegfried the numerous misinterpretations and wrong inferences due to the author's bias. It has been used as a storehouse by enemies of the Jews, who have often drawn from it charges devoid of all foundation. The substance of the work was presented in English by Stekelin, under the title *The Traditions of the Jews, with the Expositions and Doctrines of the Rabbins* (1732-34). A new edition of the original was published by Schieferl (1892). Consult: A. Th. Hartmann, *Johann Andreas Eisenmenger und seine jüdischen Gegner* (1834); Franz Delitzsch, *Rohling's Talmudjude beleuchtet* (1881); Siegfried, in *Deutsche Biographie*, vol. v. pp. 772 f.; G. Dalman, in Herzog-Hauck's *Real-Encyclopädie*, vol. v, pp. 276 f.

**EISENSTADT**, *Ízen-stät*, or **KISMARTON**. A town of Hungary, County of Odenburg, in the centre of rich vineyards, at the foot of the Leitha Mountains, about 25 miles south-east of Vienna (Map: Austria-Hungary, E 3). Its chief architectural feature is the magnificent palace of Prince Esterházy, erected in 1683 and enlarged in 1805. The palace is situated amid fine grounds, and its library is particularly rich in musical manuscripts. In the church of the Franciscan monastery is the burial vault of the Esterházy family. Near the town is the church of Maria-Einsiedel, a favorite resort of pilgrims and the burial place of the composer Joseph Haydn, who was the conductor of Prince Esterházy's orchestra from 1760 to 1790. Pop., 1900, 3067; 1910, 3073.

**EISENSTEIN**, *Ízen-stin*, FERDINAND GOTTHOLD MAX (1823-52). A German mathematician, born in Berlin. He wrote for Crelle's *Journal* at the age of 15, secured his doctor's degree after only three semesters at Breslau, was adjunct professor at that university at 24, and was a member of the Berlin Academy at 29. Although he died before he was 30, his literary work was extensive. He wrote on the theory of numbers, theory of functions, and other branches of higher mathematics; 37 of his memoirs being found in the first 50 volumes of Crelle. Gauss ranked him with Archimedes and Newton in point of natural ability in mathematics. There is a biography by Rudio,

with some autobiographical matter, in the *Abhandlungen zur Geschichte der Mathematik*, vols. vii and viii (Leipzig, 1895).

**EISFELD**, is'fêlt, THEODOR (1816-82). A German-American musician and conductor. He was born at Wolfenbüttel, Germany, and when but 23 years of age was appointed kapellmeister of the Court Theatre of Wiesbaden, which position he held for four years (1839-43), going afterward to Paris, where he had the direction of the *Concerts Vivienues*. In 1848 he moved to New York and became one of the leading factors of musical America, taking an especially active part in the musical life of New York. He was the conductor of the Philharmonic and of the Harmonic societies and, in connection with Noll, Reyer, and Eichhorn, established the celebrated quartet *soirées* of 1851. A nervous affection caused by shock arising from the burning of the ocean steamer *Austria* (in 1865), of which he was one of the few survivors, cut him off from all further musical activity. He died at Wiesbaden.

**EISK**. See YEISK.

**EISLEBEN**, is'la'bên. A town of the Prussian Province of Saxony, situated about 18 miles west-northwest of Halle (Map: Prussia, D 3). It is the centre of a rich mining district and consists of the old town, new town, and three suburbs. Martin Luther was born at Eisleben in 1483 and died here in 1546. The house in which he was born, partially destroyed by fire in 1689, was rebuilt through voluntary contributions and converted into a free school. The house where he died has also been restored and contains numerous relics. The church of St. Andrew contains Luther's pulpit, busts of Luther and Melancthon, and monuments of the counts of Mansfeld. In the church of St. Peter and St. Paul are preserved the font in which Luther was baptized, his leather cap, and a fragment of his cloak. The town has a gymnasium, founded by Luther two days before his death. The chief industry of Eisleben is the smelting of copper and silver, from nearby mines. Pop., 1900, 23,900; 1910, 24,629. Eisleben, known in the tenth century as Islebin, came into possession of the counts of Mansfeld in the twelfth century, to whom it belonged until the extinction of that line in 1780; then it passed to Saxony and, in 1815, to Prussia.

**EISTEDDFOD**, âs-tên'vôd (Welsh, from *eistedd*, to sit, and *bod*, to be; pl. *eisteddfodau*). A Welsh word, meaning literally "sitting," or "session." It is applied to the assemblies of bards and people meeting for competition in Welsh poetry and prose and in music, both vocal and instrumental. There are two kinds of *eisteddfodau*—the national or general body, and the provincial gatherings which take place in many parts of Wales and even among the Welsh in foreign countries, especially in the United States. Though the institution bears all the marks of antiquity, the meetings which are traditionally ascribed to the fifth, sixth, and seventh centuries can hardly be deemed historic. Originally the principal function of the *eisteddfod* was to license or admit duly qualified candidates to the position of recognized bards or minstrels. This position included many privileges, among them the right to a billet which every nobleman was bound to respect. About the year 1100 Gruffyd ab Cynan is supposed to have held a great national eis-

teddfod at the ancient town of Caerwys in Flintshire, and in 1176 Lord Rhys (Rhys ab Gruffyd) is known to have held at his castle of Cardigan a grand festival with both poetical and musical competitions—the earliest eisteddfod of which we have any actual account. In the twelfth century it had become a regularly constituted court. Again, in the time of the Tudors we find the eisteddfod recognized as a tribunal of authority, and Queen Elizabeth in 1568 issued a commission for holding one. In the seventeenth century, because of the unsatisfactory condition of the Welsh professional world, the eisteddfod seems to have fallen into abeyance. The last petition to hold one, of which we have any note, was made by the gentry of North Wales in 1594 and was apparently not granted. During the nineteenth century it was revived and has now become an institution of prime importance for the intellectual life of the Welsh people. The national gathering is held every year in North and South Wales alternately and is attended by many thousands of people. While it has achieved success in encouraging literature and music, it has accomplished little towards the development of art. Consult Rhys and Brynmor-Jones, *The Welsh People* (London, 1909). The programmes of some recent eisteddfodau have been published in *Y Cymmrodor*. See BARD.

**EITELBERGER VON EDELBERG**, *Eitelbérk'ér fön a'del-bérk*, RUDOLF (1817–85). An Austrian art historian, born at Olmütz. He was made professor of the history of art at the University of Vienna in 1852 and in 1864 took an active part in the founding of a School of Decorative Arts and of the Museum of Arts and Industries at Vienna, of which he remained the director until his death. His works, critical and historical, have done much to stimulate the study of art and to promote the industrial arts in Austria. Among them are: *Die Reform des Kunstunterrichts* (1848); *Mittelalterliche Kunstdenkmale des österreichischen Kaiserstaats* (1858–60); and, in collaboration, *Quellschriften für Kunstgeschichte und Kunsttechnik des Mittelalters und der Renaissance* (1871–82); *Gesammelte kunsthistorische Schriften* (4 vols., 1879–87).

**E'JA** (Egypt). The desert saw viper. See SAW VIPER.

**EJECTMENT** (from *eject*, from Lat. *ejicere*, to throw out, from *e*, out + *jacere*, to throw), **ACTION OF**. An action brought to recover possession of land and also to obtain damages for its being wrongfully withheld from the person who brings the suit. This, in the common-law practice, is the only surviving instance of a mixed action; i.e., one partaking in part of the nature of a real action for the recovery of the land, in part that of a personal action for damages. The origin of the action is to be found in the old writ of *ejectio firmæ*, or *termæ* (ejectment for a term of years), which (originally only an action in trespass whereby a tenant for years could recover damages for an eviction or ouster) was so shaped as to entitle him to recover the possession of his lands. Being a simpler and more expeditious remedy than the various possessory actions provided by the common law, such as the writ of *novel disseisin*, and the like, for recovering the possession of freehold lands, it came in process of time to be employed for this purpose in all cases of wrongful dispossession until it had

completely superseded the more cumbersome remedies afforded by the common-law writs.

The process of establishing title to real estate by this action was formerly—and still is in some jurisdictions—a most intricate and serious one. As has been said above, the original action of ejectment was brought, not to try the title to the land nor to recover the land itself, but to enable a tenant for years to recover damages for the injury sustained on account of being deprived of the use of the land. Thus, the action could be brought only by, or in the name of, a tenant for years, and the plaintiff was required to show (1) good title in the owner alleged, (2) a lease by him to the plaintiff, (3) entry on the land by the plaintiff, and (4) ouster from the land. But as, when it was desired to test the question of title or to recover the possession of the land, this state of facts very likely might not exist, and as common-law procedure had provided no other way of testing the title, a series of fictions was introduced to meet these requirements. The plaintiff in ejectment thus became a fictitious tenant, suing under the name of "John Doe" (q.v.) in behalf of the person (alleged to be his lessor) who was really claiming possession.

In England this form of action of ejectment was abolished in 1852, though the name was still retained. By the judicature acts of 1875 actions for the recovery of land were placed on the same footing as other actions, and what had been retained of the old common-law action was superseded by a simple and uniform method. Legislation to a similar effect has been adopted in several of the United States; in others the action of ejectment is maintained in much the same condition in which it was left after the English Act of 1852; in a very few others the ancient form is still in use. The remedy given by an action of ejectment is one that may ordinarily be used for the recovery only of corporeal property, not of incorporeal hereditaments, such as an easement or a profit *à prendre*, though there are a few instances of its use for the latter purpose also; nor will such an action lie to recover personal property. An action of ejectment may be brought by any one who has the legal right to enter and possess the land, without regard to the exact character of his estate therein; and any person may be made defendant who has wrongfully seized or held the property under a claim of right against one holding a lawful estate therein. The burden of proof of title lies with the plaintiff, the presumption of law being in favor of the actual possessor, who need not, therefore, prove his own title otherwise than against the plaintiff. The verdict in an ejectment suit is for the plaintiff to recover peaceable possession of the land or for the defendant to retain his possession. Under the old practice the damages which might be given to the plaintiff, together with possession, were purely nominal; a supplementary suit was necessary if substantial damages were really demanded. But under the later English practice and in most of the United States substantial damages may be granted in the original action. Such damages may also be in the nature of an accounting for mesne, or intermediate, profits. Consult: Blackstone's *Commentaries on the Laws of England*; Stephen, *New Commentaries on the Laws of England* (14th ed., London, 1903); Digby, *Introduction to the History of the Law of Real*

*Property* (5th ed., Oxford, 1899); Pollock and Maitland, *History of English Law* (2d ed., Boston, 1899); Powell, *Practical Treatise on the Law of Ejectment* (Atlanta, 1911); Williams and Yates, *The Law of Ejectment* (2d ed., London, 1911). See ACTION; POSSESSION, LAW OF; TITLE; LEASEHOLD; ESTATE.

**EJOO PALM.** See GOMUTI.

**EKATERINBURG**, yá-kä'tá-rén-nô-där'. A fortified town in the Province of Ekaterinodar, situated on the east slope of the Ural Mountains, on both banks of the Isset, 180 miles southeast of Perm and 1200 miles east-northeast of Moscow (Map: Russia, K 3). Ekaterinburg is the seat of an archbishopric and of the administration for the Ural mines and is in the centre of the mining industry of these mountains. Among its institutions are a museum of mineralogy, an excellent chemical laboratory, a school for miners, a meteorological observatory, an Imperial mint, and a factory for cutting and polishing precious stones. A considerable trade, principally in cattle, tallow, and iron, is carried on. Ekaterinburg is connected by rail with Cheliabinsk, on the Trans-Siberian line. In the vicinity are the gold mines of Niviansk and Beresov. Platinum mines are also worked in the region. Ekaterinburg was founded by Peter the Great in 1722 and was named after Empress Catharine I. Pop., 1904, 52,230.

**EKATERINODAR**, yá-kä'tá-rén-nô-där'. The capital of the Kuban Province, northern Caucasia, situated on the right bank of the Kuban, over 150 miles south-southwest of Rostov and 960 miles south of Moscow. It is a fortified town and is surrounded on all sides by swamp and morass. The streets are broad and straight, but unclean (Map: Russia, E 5). The territorial Museum of Natural History is in Ekaterinodar. Farming, gardening, cattle raising, and fishing are the principal industries of the town. It holds three active fairs annually and is the seat of a considerable trade in cattle and cereals. Ekaterinodar was founded in 1794 by Dnieper Cossacks and named after the Empress Catharine II. Pop., 1897, 65,760; 1910, 99,600.

**EKATERINOSLAV**, yá-kä'tá-rén-nô-släf'. A fortified town of South Russia, capital of the Government of Ekaterinoslav, situated on the right bank of the Dnieper, above its rapids, 250 miles northeast of Odessa and 630 miles southwest of Moscow (Map: Russia, D 5). A monument of the Empress Catharine II, the old palace, once the residence of Prince Potemkin, and, above all, the remarkable bridge across the Dnieper, are among its most noteworthy structures. There are numerous churches, including one of Protestant denomination, and the educational institutions include a technical trade school, with free lectures. Ekaterinoslav has two fine parks, the one on the banks of the river being especially attractive. The city is growing rapidly. There are a number of steam flour mills, foundries and tanneries, in which over 5000 persons are employed. The position of the city on the Dnieper is very favorable to its commercial and industrial development, but its direct communication with the Black Sea is greatly impaired by rapids. A large trade is carried on, chiefly in grain, cattle, timber, and wool. The city is the terminus for timber which is floated down the Dnieper. There are held three fairs during the year. Pop., 1900, 135,552; 1909, 195,870. The Polish fortress

Kaidaki, built in 1635, occupied the present site of Ekaterinoslav. In 1778 a district town by the name of Ekaterinoslav was founded by Prince Potemkin on the Samara River; but, owing to the insalubrity of the site, the town was removed to the present site of Ekaterinoslav in 1783.

**EKATERINOSLAV.** A government in South Russia, bounded by the governments of Poltava and Kharkov on the north, the Province of the Don Cossacks on the east, the Sea of Azov and the Government of Taurida on the south, and Kherson on the west (Map: Russia, E 5). Its area is about 24,478 square miles. It forms an extensive steppe with some elevations along the rivers and almost without forests. It is watered chiefly by the Dnieper and the Donetz. The climate is moderate and the winters short. The average temperature varies from about 20° F. for the winter to nearly 72° F. for the summer. The soil is very rich in minerals, and the government forms one of the chief mining centres of European Russia. There are vast deposits of coal, iron, zinc, and salt. Agriculture and stock raising engage most of the inhabitants. There are raised large quantities of wheat, potatoes, and tobacco, also some southern fruits. The annual output of coal exceeds 2,000,000 tons, of which a considerable part is mined by peasant associations. The chief manufacturing establishments are machine works, flour mills, foundries, glass, soap, candle, and tobacco factories, breweries, etc., and the total number of people employed exceeds 53,000. The government has a considerable trade in minerals, cereals, and lumber, and is well provided with railways. There is also considerable shipping on the Dnieper. Fishing is also a notable industry along the banks of the Don and Dnieper. Ekaterinoslav was created a government in 1802 and until 1887 comprised also the territory along the northeastern end of the Sea of Azov, now included with the Province of Don Cossacks. Pop., 1897, 2,113,674, composed mainly of Little Russians, but including also Great Russians, Greeks, Jews, Armenians, Rumanians, Poles, etc.; 1911, official estimate, 3,138,200. Capital, Ekaterinoslav (q.v.).

**EKERÖ**, ä'ker-ë, or **ECKERÖ**. One of the Åland Islands (q.v.), Finland, at the entrance to the Gulf of Bothnia. It lies west of Åland and occupies an area of over 32 square miles. Pop., about 1200, mostly Swedes. Its chief place is the village of Ekerö.

**EKHMIM**, êk-mēm'. See AKHMIM.

**EKHOF**, or **ECKHOF**, êk'hôf, KONRAD (1720-78). A distinguished German actor and playwright, one of the creators of the modern German drama. Born amid humble surroundings at Hamburg, he became in his youth a lawyer's clerk, and while in this situation he made assiduous use of his master's library and resolved to become an actor. His début was made in a travelling company at Lüneburg, as Xiphaires in Racine's *Mithridate*, the German stage being then largely dominated by French influence. He played in various German cities and gained a considerable reputation. In 1764 he went to Hamburg and soon became a member of the national theatre there. In 1769 he went to Hanover and five years later became director of the court theatre of Gotha, where he remained till his death. He was a powerful actor, winning the admiration of such men as Iffland and Lessing. He was also the author of poems and of

several adaptations from the French drama, notably *Die Mutterschule* (1753) and *Die wüste Insel* (1762). Consult Uhde, "Konrad Ekhof," in *Der neue Plutarch* (Leipzig, 1877), and Rüschnier, *K. Ekho's Leben und Wirken*.

**EKKEHARD**, ĕk'ke-härt. An important historical romance dealing with the tenth century, by Scheffel, published in 1855. It is based on researches in the chronicles of the monastery of St. Gall and describes the love of the monk Ekkehard for Hadwig, Duchess of Swabia.

**EKKEHARD VON AURA** (?-c.1125). A German chronicler and monk. He was appointed abbot of the monastery of Aura, near Kissingen, in 1108 and wrote the best mediæval chronicle of the world and an admirable history of the First Crusade, *Hierosolymita*. The former, *Chronica Ekkhardi Uraugiensis*, was published by Waitz in *Monumenta Germaniæ Historica: Scriptores*, vol. vi (Berlin, 1883).

**EKRON** (Heb. 'eqrôn, probably connected with 'āqār, Ar. 'āqra, sterile). The most northerly of the five cities of the Philistines (Josh. xii. 3) (Map: Palestine, B 4). In Josh. xv. 45 it is assigned to Judah, in Josh. xix. 43 to Dan, and therefore appears to have been included, at one time or another, within the real or ideal borders of these tribes; Josh. xiii. 2 ff., it still belonged, after the conquest, to the unconquered territory of the Philistines. It is mentioned in a list of towns conquered by Thothmes III (1501-1447 B.C.). The ark of Yahwe, when captured by the Philistines, was taken first to Ashdod and then to Ekron, whence it was sent back to Israel (1 Sam. v. 10; vi. 16; the Greek version, however, in these passages has Ashkelon). Before the expedition to Syria by Sennacherib, in 701, "the officials, nobles, and people" of Ekron threw off their allegiance to Assyria and sent their King, Padi, who remained loyal, to Jerusalem, where Hezekiah held him in prison. Sennacherib captured Ekron, restored Padi, and gave him a part of the Jewish territory. In the days of Esarhaddon and Asurbanipal, Ikausu reigned in Ekron. His name has been compared with that of Achish. There was a famous sanctuary of Beelzebub (q.v.) in Ekron, to which Ahaziah of Israel sent for an oracle when he was ill (2 Kings, i. 2). The city was given to Jonathan, the Hasmonean, by Alexander Balas (1 Mace. x. 89). After the destruction of Jerusalem in 70 A.D. Jews settled in Ekron. It is mentioned in connection with the expedition of Baldwin I in 1100 A.D. to the Philistine plain as situated between Jamnia and Ashdod. A place called Akir already in the time of Robinson was selected by Baron Rothschild for a Jewish colony in 1884. It has now about 300 inhabitants. Many scholars think that it represents the actual location of the ancient Ekron, but others doubt this identification. There are no ruins of the old city. Consult: Robinson, *Biblical Researches*, ii, pp. 227 ff. (1838); *Gaza und die philistäische Küste* (1852); McAlister, *The Philistines: Their History and Civilization* (1913).

**ELÆAGNA'CEÆ**. See ELÆAGNUS.

**ELÆAGNUS** (Neo-Lat., from Gk. ἐλαγιγνος, *elagiγnos*, *elāyγnos*, *elagnos*, sweet gale, myrica, from *ēlaia*, *elāia*, olive tree + *āyγnos*, *agnos*, tree like a willow). A genus of dicotyledonous plants, of the family Elæagnaceæ. This family consists of trees and shrubs; usually covered with scurfy scales, and having alternate or op-

posite entire leaves without stipules. There are only about a dozen species, all natives of the Northern Hemisphere, but found both in its warm and cold regions. The oleaster (*Elæagnus angustifolia*), sometimes called wild olive, a native of the south of Europe and the Levant, is a spiny tree of 15 to 20 feet in height, with lanceolate leaves, which, as well as the young shoots, are hoary with stellate hairs. It is frequently planted for the sake of its silvery-white foliage and its very fragrant small yellow flowers. The oleaster has been introduced into the United States as an ornamental, and has proved satisfactory even in Minnesota and South Dakota. Silverberry (*Elæagnus argentea*), so called on account of the silvery-white scales that cover the leaves, is a common shrub from Canada to Utah. The berry is edible. A number of Japanese species are evergreen and are cultivated as ornamentals, but they are not hardy except in the South. The berries of many species are edible. The buffalo berry (*Shepherdia argentea*), a North American shrub of the thirty-ninth parallel triangulation (Western thorn) (*Hippophaë rhamnoides*), is the only British species of this family.

**ELÆIS**. See OIL PALM.

**ELÆOCOC'CA** (Neo-Lat., from Gk. ἐλαία, *elaia*, olive tree + κόκκος, *kokkos*, grain, seed). A former genus of plants of the family Euphorbiaceæ, the seeds of some of which yield useful oils. The oil obtained from *Elæococca verrucosa* is used for food in Japan, notwithstanding its considerable acidity. The tree is cultivated in the Mauritius, and the oil is there used only for burning. That obtained from *Elæococca*, or *Dryandra*, *vernica* is used in China for mixing paint. The species of this genus are now generally referred to Aleurites. The candlenut or candleberry tree (*Aleurites triloba*) is widely distributed in tropical regions, and *Aleurites cordata* of Japan is one of the trees that yield, by the agency of the lac insect (*Casteria lacca*), the lac of commerce. The fruit of these species yields a valuable drying oil that is in demand for making varnish. It is known as wood, tung, or kukui oil. Both *Elæococca verrucosa* and *Elæococca vernica* are now grouped together under the name *Aleurites cordata*.

**ELÆODEN'DRON** (Neo-Lat., from Gk. ἐλαία, *elaia*, olive tree + δένδρον, *dendron*, tree). A genus of trees of the natural family Celastraceæ. *Elæodendron glaucum*, a native of Ceylon and the south of India, is sometimes called the *Ceylon tea tree*, from the resemblance of its leaves to those of the tea shrub. The fine-grained, hard, and tough timber of saffronwood (*Elæodendron croceum*) of the Cape of Good Hope is much used in building and cabinet-making. The fruit of some South African species is edible. That of *Elæodendron argan*, now called *Argania sideroxylon*, yields an oil similar to olive oil, which is much used by the Moors. See ARGAN.

**ELÆ'OLITE**. A common massive variety of nephelite (q.v.), sometimes occurring in large coarse crystals. It has a greasy lustre and is reddish, greenish, or gray in color.

**EL'AGAB'ALUS**, incorrectly **HE'LOGAB'ALUS** (204-222). Emperor of Rome from 218 to 222. He was born at Emesa, Syria. His real name was Varius Avitus Bassianus; but having, when a mere child, been appointed high priest of the Syro-Phœnician sun god Elagabal, he assumed the name of that deity. Soon

after the death of his cousin Caracalla, Elagabalus was proclaimed Emperor by the soldiers, in opposition to the legitimate sovereign, Macrinus, who had offended the troops from the severity of his discipline. The rivals met in battle at Antioch in 218 A.D. Macrinus was defeated, and Elagabalus quietly assumed the purple. His reign, which lasted rather more than three years and nine months, was infamous for the almost unparalleled debaucheries in which he indulged. He was murdered in an insurrection of the prætorians on March 11, 222, and was succeeded by his cousin and adopted son, Alexander Severus. Consult Duviuet, *Héliogabale* (1903), and Butler, *Studies in the Life of Heliogabalus*, in "University of Michigan Studies: Humanistic Series," vol. iv (1908).

**ELAINE**, é-lān'. A favorite woman's name in the Arthurian legends. 1. The half sister of Arthur, who bore his illegitimate son, Modred. 2. King Pelles's daughter, who bore Sir Galahad, Launcelot's son. 3. The maid of Astolat, who died for love of Launcelot, and whom Iennyson has celebrated in the poem *Elaine*. 4. The daughter of King Brandegoris, who had a child by Sir Bors de Ganis. 5. Launcelot's mother, the wife of Ban of Brittany.

**ELAIOMETER**. See OLEOMETER.

**ELAIOPLASTS**, é-lā-ō-plāsts (from Gk. *ἐλαίον*, *elaion*, olive oil + *πλαστός*, *plastós*, formed, from *πλάσσειν*, *plassein*, to shape). Protoplasmic bodies, containing imbedded oil drops, which occur in the epidermis of various lilies and orchids. They are believed by their discoverer, Wakker, to have the function of accumulating oil in much the same fashion as the leucoplasts accumulate starch. See LEUCOPLASTS.

**ELAIOSOMES**, é-lā-ō-sōmz (from Gk. *ἐλαίον*, *elaion*, olive oil + *σῶμα*, *sōma*, body). The seeds of certain plants have upon them external oil bodies, or elaiosomes, that cause them to be transported by ants which use the oil bodies for food. These bodies form various appendages to seeds and fruits, but are usually more or less prominent ridges or knobs near their point of attachment. See MYRMECOPHORY.

**ELAM**. A country including the high plateau traversed by the Zagros and Pushti chains and the great plain east of the lower Tigris and north of the Persian Gulf. It corresponded in a general way to the modern Khuzistan, in part to the Susiana and Elymais of the Greek classical writers. The name is derived from the Assyrian *Ilamtu*, 'the highlands,' and seems to be a translation of the Sumerian *Nimma*. The native designation appears to have been *Shushunka-Anshan*. *Shushunka* was the source of the Greek name *Susiana* and denotes the territory ruled from the capital *Shushan*. (See *SUSA*.) *Anzan*, or *Anshan*, is a more ancient native name and indicates the region subject to the city of *Anzan*. The situation of this city has not yet been definitely identified, but it is so closely connected with *Susa* that it may have been a twin city inhabited chiefly by the native element. (See *ANZAN*.) In later times the name seems to have been used of the whole territory. Cyrus apparently reigned in *Susa* as King of *Anshan*. The Greek *Elymais* was derived from the Semitic name and was probably identical with *Susiana*. From the highlands descended the great rivers of *Elam*, the *Karun* (*Udai*, *Bulaios*), the *Kercha* (*Uknu*, *Choespes*), and others. The valleys were ex-

ceedingly fertile, while in the southwestern plains the heat may not have been so intense in ancient times as at present. As to the ethnic relations of *Elam* in antiquity, our knowledge is yet quite scanty. It is impossible to determine how long those races have been in the land that are found there to-day. The negroes may be a comparatively late importation. Recent research renders it probable that the *Ar-yan*s were in the land at a much earlier date than has been supposed. Semitic *Akkadians* were there already in the time of *Sargon I* of *Agade*. "*Turanian*" elements are more likely to have found their way into the country in the last 1000 years than in earlier periods. The mass of the people may have belonged to the large family of nations of which the people of the *Caucasus* are the present representatives. There is a certain similarity between the *Elamitic* dialects and the *Georgian*, *Udic*, and *Guric* languages, which suggests this. The dialects in which inscriptions have been preserved are (1) the Old *Elamitic*, (2) the *Anzanian*, (3) the *Mal Amir*, (4) the *Susian* dialect. Another dialect, the *Kashite*, is known through *Babylonian* inscriptions. Partly through these records, which have greatly multiplied in recent times through the French excavations at *Susa*, and partly through *Babylonian* and *Assyrian* sources, light is thrown upon certain periods of the history of ancient *Elam*. *Eannatum* of *Lagash* fought with *Elam*; 600 *Elamites* attacked *Lagash* in the time of his nephew *Entemena*. The country was conquered by *Sargon I* of *Agade*, and held by *Rimush*, *Manishtusu*, *Sargon II*, and *Naram-Sin*. *Gudea* of *Lagash* fought with *Anshan* in *Elam*, and used *Elamites* and *Susians* in the building of a temple. After the fall of the dynasty of *Akkad* and during the *Gutian* period, *Elam* was independent. To this time belong *King Basha Shushinak* and the dynasty founded by *Ebarti* and his son *Silhaha*. *Kudur-Nanchundi I* conquered *Babylonia* in 2285 B.C. *Sinti Shilchak* was his successor. *Kudur Mabuk*, Prince of *Yamutbal*, an *Elamitic* principality between the *Pushti Kuh* and *Jebel Hamrin*, styles himself "father of *Martu*" (probably *Syria*). His son *Rim Sin* was vicerent in *Larsam* until he was conquered by *Hammurapi* in the thirtieth year of his reign, or 2094 B.C. A *Kushite* chief, *Gandesh*, invaded *Babylonia* and founded a powerful dynasty there (1761-1185 B.C.). Inscriptions have been found of *Untashgal*, King of the *Susian Anzan*, in 1700 B.C. *Churbatila* of *Elam* fought with *Kurigalzu II* of *Babylon* (1338-1233 B.C.) and was taken captive at *Kar Dungi*. After this *Babylonian* conquest of *Susa*, *Inshushinak*, his son *Shatrak Nanchundi*, and grandson *Shilchak Shushinak* (c.1150 B.C.) seem to have reigned. *Nabukuduruzar I* (c.1160-1130 B.C.) and *Mar-duknadinachi* (c.1120-1105 B.C.) fought with *Kashi* and *Elam*, as did also *Samsi Adad II* (825-812 B.C.) and *Adadnirari III* (812-783 B.C.), who conquered *Illip* (northeast part of *Elam*) and *Umliash* (between *Jebel Hamrin* and the *Euphrates*). Owing to the frequent references to *Elam* in the *Assyrian* inscriptions from the time of *Tiglath-pileser IV* (745-728 B.C.) to that of *Asurbanipal* (668-625 B.C.), it is possible to give an approximately correct list of kings with their dates for 100 years: *Chumbanigash* (742-717 B.C.), *Shutruk Nanchundi* (717-699 B.C.), *Challudash* (699-693 B.C.), *Kudur Nanchundi III* (693-692 B.C.), *Chumbami-*

nanu (692-689 B.C.), Chumbachaldash I (689-681 B.C.), Chumbachaldash II (681-675 B.C.), Urtaki (675-664 B.C.), Tammariu I (664-657 B.C.), Tiumman (657-655 B.C.), Tammariu and Chumbanigash (655-648 B.C.), Indabigash (648 B.C.), Chumbachaldash III (647 B.C.), Tammariu II and Chumbachaldash III (647-642 B.C.). The long struggle between Elam and Assyria, during which Sennacherib was humiliated in 694 B.C. by Challudash, who carried away his son Asurnadinshum from Babylon, and in 690 B.C. by Chumbaminanu, who probably won the battle of Chaluli, led to the imposition of Assyrian suzerainty in 655 B.C., and the final destruction of the state in 642 B.C., when Susa was razed to the ground, and 32 statues of kings and all the images of the gods were carried away to Nineveh. How long the Assyrians were able to maintain their power in Elam is not known. Jer. xlix. 35-39 cannot be quoted to show the condition in the time of Nebuchadnezzar, for this prophecy was probably written at the end of the Achemænian period, and Elam stands for Persia. Media under Cyaxares and Astyages claimed suzerainty over Elam. But the Hatamti kings whose inscriptions have been found at Mal Amir seem to have been quite independent in the beginning of the sixth century, and the same is probably true of Teispes, Cyrus I, Cambyses I, and Cyrus II as kings of Anshan. In the Achemænian period Elam was loyal to Cyrus, Cambyses, and Smerdis, rebelled against Darius, but remained a favored satrapy, whose capital was one of the residence cities of the kings. For the recent excavations in this city, see SUSA. See also CUNEIFORM INSCRIPTIONS.

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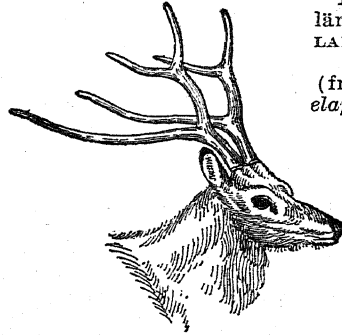
**ELAND** (Dutch, elk, Ger. *Elend*, Lith. *ėlnis*, stag, Gk. ἑλός, *elos*, fawn). The largest of African antelopes (*Taurotragus oryx*). It is so bovine in general appearance that it was at once called elk by the Dutch pioneers of South Africa, and the males and females are yet spoken of as bull and cow. It is as large as a tall horse, well-grown examples reaching 6 feet in height, and weighing sometimes as much as 1500 pounds, though the average weight does not exceed 1000 pounds. The massive form is shown in the illustration on the Plate of ANTELOPES. The usual color is a bright rich fawn, with the hair short and smooth; but in age the bulls lose much hair so that the blue tint of the skin shows beneath it. A broad, deep-fringed dewlap reaches to the knee. The horns are very strong, rise straight upward, with considerable spreading, and are about 28 inches long in large bulls and a little longer, but more slender, in

the cows. The flesh is exceedingly good eating (except in the dry season), and the hide of much value for harness, etc.; moreover, their gentleness, weight, and consequently their comparative slowness, with their habit of moving in herds, make them a comparatively easy prey. Hence the elands were practically exterminated from South Africa by 1890, and those of Central Africa were nearly swept away by rinderpest a few years later. Very few are left even in the remotest districts. Many examples have been kept in captivity and found amenable to domestication. Native names were canna and impofo. In Western Equatorial Africa a second and considerably larger species, or subspecies (*Taurotragus derbianus*), still exists in large numbers. Consult Lydekker, *Game Animals of Africa* (London, 1908), and Roosevelt and Hellen, *Life-Histories of African Game Animals* (New York, 1914).

**ELANSK**, ye-länsk'. See YE-LANSK.

**EL'APHURE**

(from Gk. ἔλαφος, *elaphos*, stag + οὐρά, *oura*, tail). A book name for David's deer (*Cervus davidianus*) of northern China and Manchuria. It is frequently kept in parks by Chinese nobles and has been similarly



ANTLERS OF ELAPHURE.

kept alive in Europe, but in regard to its wild habits little is known. It is of the rucervine type, resembles in size and form the Indian swamp deer (q.v.), but has long shaggy hair. It is peculiar in having no brow tine to the antlers.

**ELAPIDÆ** (Neo-Lat. nom. pl., from Lat. *elaps*, *elops*, Gk. ἔλλοψ, *ellops*, sort of sea fish). A family of proteroglyph venomous terrestrial serpents, the coral snakes and their allies, with grooved fangs. Elapidæ of moderate size and great beauty are found in America (genus *Elaps*), in Africa (genus *Microsoma*), and in Australia (genus *Vermicella*). The American species inhabit the tropics, except three species in the southern United States. See CORAL SNAKE, and Colored Plate of SNAKES, FOREIGN VENOMOUS.

**EL-ARABAH**, ʿel-ā'ra-bā, WADI. A portion of the depression or "rift" valley which extends from the foot of Mount Hermon southward to the Gulf of Akabah, at the head of the Red Sea. It is one of the most remarkable depressions on the globe, being 682 feet below sea level at the Sea of Galilee and 1292 feet at the Dead Sea. About 6 miles south of the Dead Sea it is crossed by a line of chalk cliffs, and the valley north of this point is now named EL-Ghōr. The southern part of the valley, which still bears the Hebrew name El-Arabah, is about 100 miles in length and from 3 to 12 miles in breadth. See ARABAH.

**EL-ARASH**, ʿel-ā-rish'. See LABASH.

**EL-ARISH**. An Egyptian city and fortress on the Mediterranean and on the Wadi el-Arish, which marks the Palestine frontier (Map, Egypt, C 1). It is the chief city of a territory bearing the same name. The city proper contains about 5000 inhabitants. About 13,000



nomads roam over the territory. In the Middle Ages the city was known as Laris. King Baldwin I of Jerusalem died there in 1118. The French under Kléber took it in 1799, but were obliged to abandon it the same year.

**EL'ASIP'ODA.** See HOLOTHURIAN.

**ELASMOBRANCHII**, é-lās'mō-brān'kī-i (Neo-Lat. nom. pl., from Gk. *ελασμός*, *elasmós*, metal plate + *βράγχια*, *branchia*, gills), or CHONDROPTERYGII. A group of fishes whose skeleton consists of cartilage and connective tissue alone, there being no distinct bones present, comprising only the sharks, rays, and chimæras. The cranium is composed of a single piece, without sutures and separate parts as in the higher vertebrates. The skin is in nearly all cases provided with placoid scales. The males in the recent forms have the ventral fin modified into copulatory organs known as claspers. The caudal fin is heterocercal. The gill slits, five to seven in number, open directly to the exterior (except in the chimæras), and the gill filaments are fastened for their whole length to the interbranchial partitions. The intestine has a spiral valve, a fold of its wall into the interior arranged in a spiral fashion. No swimming bladder is present. The eggs are large and few in number and are fertilized inside the body of the mother, where in many cases they undergo development. The two main groups, viz., the Selachii, which comprises the sharks and rays, and the Holocephali, or chimæras, include, besides the many living, many extinct forms, our knowledge of which (the skeleton being cartilaginous and therefore not preserved) is derived from fossilized teeth and dermal scales. Fossil remains of the Selachii first appear in the Upper Silurian and throughout the Paleozoic times are very abundant. The Holocephali appear first in the Lower Jurassic, a few probable remains having been found in the Upper Silurian. It is among the elasmobranchs that we find the most primitive type of fishes. One of these more generalized primitive groups, the Cestracient (q.v.), abundant in Paleozoic times, is represented to-day by two or three species of Port Jackson sharks (q.v.). None of the elasmobranchs are very small, and among them are some of the largest of aquatic vertebrates. There are about 300 living species, all marine.

**ELASMOSAURUS** (Neo-Lat., from Gk. *ελασμός*, *elasmós*, metal plate + *σαῦρος*, *sauros*, lizard). A gigantic aquatic reptile of the order Saurapterygia, one of the few American representatives of the European plesiosaurs. Remains of this sea serpent have been found in the Cretaceous deposits of New Jersey. It resembled the plesiosaurs in shape, but had a flattened tail. See PLESIOSAURUS; CRETACEOUS SYSTEM.

**ELASMOETHERIUM** (Neo-Lat., from Gk. *ελασμός*, *elasmós*, metal plate + *θηρίον*, *thêrion*, wild beast). An extinct fossil rhinoceros of gigantic size, found in the Pleistocene deposits of Siberia and Russia. See RHINOCEROS.

**ELASTICITY** (from Gk. *ελαστέιν*, *elaustein*, to drive, set in motion). A general property of matter (see MATTER) in virtue of which, if it is strained in any way by means of a force, it returns to its former condition more or less perfectly when the force is removed.

**Solids.** A solid body is distinguished by having under ordinary conditions a definite volume and shape, both of which may, however, be altered by the application of suitable forces. In general, when a solid is deformed in any way

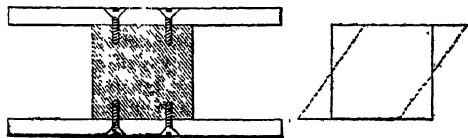
—e.g., bent, stretched, etc.—any small portion of it has both its size and shape changed. To secure a strain of the solid such that each minute portion preserves its shape and suffers a change in volume only, it is necessary to apply a uniform pressure, i.e., a uniform force per square centimeter, over the whole surface of the solid, thus compressing it equally in all directions. This can be done by immersing the solid body in some liquid—e.g., water—which can be put under a great pressure. Let the original value of the volume be  $v$  and of the pressure be  $p$ ; then if, as the result of increasing the pressure by a small amount  $\Delta p$ , the volume is decreased a small amount  $\Delta v$ , the "coefficient of elasticity for a change in volume"—or the "bulk modulus"—is defined to be

$$k = \frac{\Delta p}{\frac{\Delta v}{v}}.$$

The ratio  $\frac{\Delta v}{v}$  is called the "strain"; and  $\Delta p$ ,

the change in the force per square centimeter, equals what is called the "stress." Stress is the alteration in the pressure of the portions of the solid on each other; i.e., it is an *internal* property. It is measured, however, by the external force producing the deformation; because, when this force is applied, the body is compressed and there are forces of restitution produced which oppose the applied force and exactly balance it when there is no further compression. For any one substance, e.g., a definite kind of glass or iron,  $k$  is a constant quantity.

To produce a change in the shape of minute portions of a solid without sensibly altering their volumes, it is necessary to apply what is called a "shearing" stress, i.e., a combination of forces like that due to a pair of shears when used in cutting a piece of paper or cloth. Thus, if a cubical block of wood is held between two



boards firmly screwed to it, and if the boards are pushed slightly sidewise, but in *opposite* directions, the upper one to the right and the lower to the left, the block will have its shape changed to an oblique solid, as indicated in exaggerated form in the diagram, while the change in the volume will be infinitesimal. The angle through which the edge of the block is turned is taken as the measure of the strain; and the stress equals the force used to push one of the boards sidewise divided by the area of the cross section of the block. This stress is an internal force, being due to the reaction of the solid against the shearing forces which tend to make one layer of the solid move over the other. When there is no further alteration under the action of these external forces, they must be exactly equal and opposite to the internal forces of restitution. Calling this ratio of the force to the area  $T$ , and the angle of the strain  $I$ , the coefficient of elasticity for a change in shape—or the coefficient of rigidity—is defined as



The simplest case in practice of a pure change in shape is when a wire or rod is twisted slightly round its axis of figure; this is called "torsion." It can be shown from theoretical considerations that if a wire or rod with a circular cross section is clamped at one end and the other end twisted around the axis through an angle  $\Psi$ , a moment will be required equal to

$$\frac{\pi r^4 n \psi}{2l}$$

where  $r$  is the radius of cross section and  $l$  is the length of the wire. It is found that for any definite kind of matter, regardless of its size or shape,  $n$  is a constant quantity.

By far the commonest deformation of a solid is that experienced when a rod or beam is stretched, compressed, or bent. In all these cases it is evident that it is simply a matter of changing the length of the rod or beam, or of certain portions of it. Thus, if a wire of cross section  $A$  and of length  $L$  is clamped at one end and under the stretching force  $F$  is elongated by an amount  $l$ , the strain is defined to be  $l/L$  and the stress equals  $F/A$ . This stress, although measured by the applied force, is the internal reaction. The ratio of these two, viz.

$$E = \frac{F}{\frac{l}{L}} = \frac{FL}{Al},$$

is called "Young's modulus" because its importance was first emphasized by Thomas Young. In this deformation both the size and shape of the small parts of the wire are altered; and therefore Young's modulus must depend upon both the bulk modulus and the coefficient of rigidity. Calling Young's modulus  $E$ , it may be shown theoretically that

$$\frac{1}{E} = \frac{1}{9k} + \frac{1}{3n}.$$

Solids differ greatly in their compressibility and in their rigidity; and they differ widely in the extent to which they may be deformed and yet recover their former shape and size when released from the deforming forces. If the strain is too great, the body does not regain its former condition; the "limits of elasticity" are said to have been passed. A body is called "elastic" if these limits permit a large strain, e.g., glass, steel; while if these limits permit only small or minute strains, the body is said to be "inelastic." If, however, the strain is small enough, solids do return quite exactly to their former states; and for such small strains it is observed that the amount of the deformation produced varies directly as the deforming force. This is called "Hooke's law," from the name of the one who first proposed it, Robert Hooke. Many solids after being strained return to their previous condition slowly after the deforming force is removed; and nearly all take considerable time to reach their permanent strain when a force is applied. There is therefore a slight molecular "slipping" in general in every deformation of a solid; this necessarily involves internal friction and the production of heat effects, in particular, rise in temperature. A "perfect" solid might be defined as one in which there is no internal friction; while the more inelastic a body is, the greater are the

slipping and the internal friction when there is a deformation.

Since solids have, in general, elasticity both as to change in volume and as to change in shape, a solid medium can transmit two kinds of waves, compressional and transverse. (See WAVES.) A solid rod, too, can vibrate in several ways: longitudinally, if it is stroked lengthwise; torsionally, if it is twisted; from side to side, like a tuning fork, if it is bent.

**Fluids.** A fluid is defined to be such a form of matter as will yield to a shearing force, however small. Thus, it is necessary to discuss the elasticity of fluids with reference to changes in volume only. As before, the definition of the coefficient of elasticity is

$$k = \frac{\Delta p}{\frac{\Delta v}{v}},$$

where  $v$  is the original volume and  $\Delta v$  is the decrease in the volume accompanying an increase in the internal pressure of an amount  $\Delta p$ . For liquids  $k$  is very large, since they are so slightly compressible; for a gas, however, it is much smaller. When any portion of matter is compressed, the temperature is increased (except in most special cases); and this fact alters the value of the change of pressure corresponding to a definite change in volume. If the change in volume is to be due to the change in pressure alone, it is necessary to change the volume so slowly that the temperature remains practically constant. This is particularly important in the case of gases, because they are so easily compressed and there is accordingly such a great rise in temperature unless care is taken. If the gas is compressed so suddenly that the whole change in volume takes place before there is time for any loss of heat by radiation or conduction, the temperature will rise greatly, and this will produce a marked increase in the pressure of the gas, thus increasing the coefficient of elasticity for the gas.

The coefficient for a gas, when there is no change in temperature, may be calculated from Boyle's law for a gas, which states that as long as the temperature of a gas does not change, the product of its pressure and volume remains constant, however the volume is altered. Thus, if  $v$  is the volume of the gas when the pressure is  $p$ , and  $v - \Delta v$ , the volume when the pressure is increased to  $p + \Delta p$ , then  $pv = (p + \Delta p)(v - \Delta v) = pv - p\Delta v + v\Delta p$ , if  $\Delta p$  and  $\Delta v$  are so small that their product may be neglected. Hence  $p\Delta v = v\Delta p$  and therefore

$$k = \frac{\Delta p}{\frac{\Delta v}{v}} = p.$$

In words, the coefficient of elasticity for a gas at constant temperature numerically equals its pressure. If, however, the change in volume is made so rapidly that the heat produced has no time to escape, the coefficient equals  $\gamma p$ , where  $\gamma$  is a constant for any one gas, being equal to the ratio of the specific heat at constant pressure to that at constant volume. (See HEAT.) For air, hydrogen, and oxygen  $\gamma$  very nearly equals 1.4.

A fluid medium can transmit compressional waves only, and in these the vibrations must be rapid, otherwise the fluid would flow round the

vibrating body which is the cause of the waves. Therefore, the elasticity which is called into play is the one corresponding to no escape of heat.

	Solids		$E$
	$k$	$n$	
Glass	$4.1 \times 10^{11}$	$2.4 \times 10^{11}$	
Brass	$10.6 \times 10^{11}$	$3.8 \times 10^{11}$	$11 \times 10^{11}$
Steel	$18.8 \times 10^{11}$	$8.2 \times 10^{11}$	$20 \times 10^{11}$

	Liquids	
	Temperature	$k$
Water . . . . .	8° C.	$0.22 \times 10^{11}$
Sulphuric Ether . . . . .	10° C.	$0.07 \times 10^{11}$

## Gases

At pressure of 76 cm. of mercury.

$$1.01 \times 10^6$$

Consult: Love, *Treatise on the Mathematical Theory of Elasticity* (Cambridge, Eng., 1906); Searle, *Experimental Elasticity* (New York, 1908); Lamb, *Statics, Including Hydrostatics and the Elements of the Theory of Elasticity* (New York, 1912).

**ELASTIC LIMIT.** See STRENGTH OF MATERIALS.

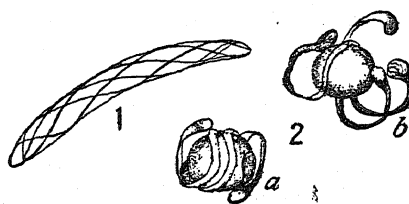
**ELASTIC TISSUE.** One of the forms of fibrous tissue, known also as yellow fibrous tissue. It derives its name from the remarkable physical property which it possesses of permitting its fibres to be drawn out to double their length, and again returning to their original length. It occurs in various ligamentous and other structures of the animal body in which elasticity is required, as in the vocal cords, the membranes connecting the cartilaginous rings of the trachea, the middle coat of the arteries, the skin, etc.

**ELASTIN** (from *elastic*). A characteristic chemical constituent of the substance of all elastic fibres of the animal body. It may be prepared from the ligamentum nuchæ of an ox by boiling with water, next heating with weak caustic potash solution, and further with dilute acetic acid; the substance thus obtained is treated with cold dilute hydrochloric acid, then boiled with strong alcohol, and finally subjected to prolonged and careful treatment with ether. In this manner gelatin, mucin, fats, etc., are removed from the tissue, the elastin remaining behind in the form of a yellowish powder which is elastic when moist, but becomes brittle on drying. By the action of strong hydrochloric acid and chloride of zinc, elastin is converted into several substances, including a small quantity of tyrosin and glycocholl; gelatin, if subjected to similar treatment, yields no tyrosin, while the true proteids yield no glycocholl and do yield glutamic and aspartic acids, which are not produced in the treatment of elastin. By means of the reaction just mentioned, elastin can, therefore, be readily distinguished from gelatin and the proteids. On the other hand, elastin may be distinguished from keratin by the action of pepsin or trypsin, which readily dissolve elastin, while they have no effect on keratin.

**ELATEA.** See CITHÆRON.

**ELATER** (Neo-Lat., from Gk. *ἐλατήρ*, *elatēr*, driver, from *ἐλαύνειν*, *elaunein*, to drive). In plants, a peculiarly modified cell developed in great numbers in the spore cases of certain liverworts, as *Marchantia*. The cells occur among the spores, and have the form of elongated fibres,

with spiral thickened bands. When the spore case bursts, the elaters ("jumpers") bend and straighten by jerking motions and help to

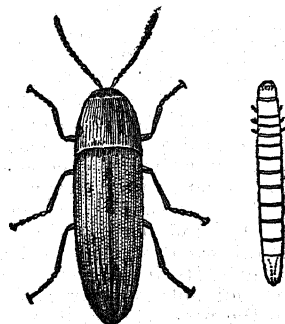


ELATERS:

1, of a liverwort; 2, of Equisetum.

loosen up the mass of spores, which are scattered by currents of air. The name elater is also applied to the hygroscopic spiral bands on the spores of Equisetum. See HEPATICÆ; EQUESETUM.

**ELATERIDÆ** (Neo-Lat. nom. pl., from Gk. *ἐλατήρ*, *elatēr*, driver). A large family of beetles, commonly known as elaters or click beetles. About 7000 species are described, of which over 500 occur in the United States. The most conspicuous North American one is the eyed elater (*Alaus oculatus*), which has two large velvety spots on the prothorax. See CLICK BEETLE; WIREWORM.



AN ELATER.

Adult beetle and larva — a wireworm (w).

**ELATERIN** (from *elaterium*),  $C_{25}H_{25}O_5$ . A neutral principle contained in elaterium (q.v.), from which it may be prepared by exhausting with chloroform, precipitating the resulting solution with ether, and purifying the precipitate by recrystallization from chloroform. Elaterin is a permanent white substance crystallizing in the form of small hexagonal scales, or in the form of prisms. It has no odor, but has a bitter, slightly acid taste. It is sparingly soluble in alcohol and in ether, and is practically insoluble in water. The triturate of elaterin is an official preparation, and is the most powerful hydragogue purgative known. It may be used, with great caution, in Bright's disease and in ascites. See ELATERIUM.

**ELATERITE.** A soft, elastic variety of asphalt resembling India rubber. It is subtranslucent, has a brownish color and a specific gravity varying from 0.9 to 1.0. It is found in Derbyshire and elsewhere in England and is of no commercial value.

**ELATERIUM** (Neo-Lat., from Gk. *ἐλατήριος*, *elatērios*, driving, from *ἐλατήρ*, *elatēr*, driver, from *ἐλαύνειν*, *elaunein*, to drive). A substance obtained from the fruit of the squirting cucumber (*Ecballium elaterium*), also called the wild cucumber. The plant is an annual of the order Cucurbitaceæ, a native of the south of Europe, common on rubbish in the villages of Greece and the Archipelago. The whole plant is rough, with stiff hairs; it has a trailing, branching stem, without tendrils; the leaves are heart-shaped,

somewhat lobed and toothed, on long stalks; the flowers axillary, yellow, the male flowers in small racemes; the fruit oblong, about an inch and a half long, grayish green, covered with soft prickles, and finally parting from its stalk, and expelling its seeds along with a thin mucus through the aperture where the stalk was inserted. It is this mucus surrounding the seeds—a thick green mucus of a very peculiar character—which contains the elaterium. To obtain the latter, the juice of the nearly ripened fruit is allowed to stand for a short time, when it becomes turbid and deposits a sediment. The sediment, carefully collected and dried, is elaterium. It is of a pale grayish-green color, light and friable, with an acrid taste and a peculiar, not unpleasant odor. It is the most powerful hydragogue cathartic in the pharmacopœia. The drug is likewise depressant and should be given with extreme caution. Its purgative action seems to depend chiefly on a principle called elaterin (q.v.).

**ELATH.** The modern Akabah (q.v.), a seaport situated in the extreme south of Idumæa, at the head of the Gulf of Akabah (Map: Egypt, C 2). According to D. ii. 8, it was one of the stations on the route from Egypt. It is probably a later designation of El-Paran (Gen. xiv. 6) and the same as Elah (Gen. xxxvi. 41). Other variant forms are Elath and Elim. David captured it from the Edomites (2 Sam. vii. 14), and under Solomon it became an important naval station (1 Kings ix. 26). Edom recovered its independence in the days of Jehoram, but subsequently Elath passed once more into the possession of Judah (2 Kings xiv. 22); again in 734 B.C., in the days of Ahaz, it passed out of the hands of Judah, and this time permanently (2 Kings xvi. 6). Later it belonged to the Edomites, the Nabatæans, and the Romans. In the days of Eusebius Elath was a town of commercial importance and carried on trade with such remote regions as India. The old Aila, or Elath, was abandoned in the ninth century, and the new city Waila became a centre of civilization. The Crusaders conquered the place in 1116. Saladin besieged and captured it in 1171. Renaud de Chatillon attacked it with a fleet in 1181 and in part destroyed the city. It is usually called simply Akabah, and belongs to Hejaz, but is connected with Maan by telegraph. There are some heaps of ruins representing the ancient Aila about one mile north of the place. See Musil, *Arabia Petrea II Edom* (Vienna, 1908).

**ELBA** (Gk. *Ἀλβεία*, *Aithaleia*, Lat. *Ilva*). A mountainous, unwooded island of the Mediterranean, the largest of the Tyrrhenian archipelago, attached to the Tuscan Province of Leghorn, Italy,  $5\frac{1}{2}$  miles southwest of Piombino (q.v.) (Map: Italy, E 5). It is 18 miles long, from 3 to 10 broad, and has an area of 86 square miles, forming part of a sunken mountain range that extends from the Italian mainland to Corsica and Sardinia. The highest point is Mount Capanne, 3350 feet. The climate is mild and healthful and the soil is fertile, but farming is neglected because of rich mineral deposits. From ancient times Elba has been famous for its iron ore, as is indicated by the name of the capital, Porto Ferrajo (iron port). Most of the inhabitants of the island (pop., 1901, 25,043; 1911, 30,450) are employed in the iron industry. Other mineral products are copper, tin, lead, marble, granite, sandstone,

and salt. Tunny and sardine fishing and the extraction of sea salt are other important industries. Elba is chiefly known as the residence of Napoleon after his first abdication, from May 4, 1814, to Feb. 26, 1815, when he escaped and returned to France, landing at Cannes, March 1. He enjoyed full sovereignty over the island, with the title of Emperor and an income of 2,000,000 francs a year. During his stay he had the road built . . . . . Porto Longone with Porto Ferrajo. The villa San Martino that he occupied still stands in Porto Ferrajo between the forts Stella and Falcone, erected by Cosimo I., Duke of Florence. In it is the *Trattato di Pace* with the inscription "Ubi cunctus fuit Napoleon." In the Middle Ages Elba was subject in turn to Pisa, Genoa, Sora, and Piombino. After Napoleon departed the island was restored to Tuscany, which became part of Italy in 1860. Consult L. Simonin, *La Toscane et la mer tyrrhénienne* (Paris, 1868), and Faticchi, *Isola d'Elba* (Florence, 1885).

**ELBASSAN**, *el-bās-sān'*. A town in Albania on the Scumbi, 35 miles east of the mouth of the river (Map: Turkey in Europe, C 4). It stands in a fertile plain surrounded by mountains, and is the seat of a Greek bishopric. There are a number of hot sulphur springs in the vicinity. It has manufactures of iron and copper wares. Pop. (est.), 15,000.

**ELBE**, *el'be* (dialectic *Albe*, OHG. *Elba*, *Alba*, from OHG. *elf*, Icel. *elfr*, river; called by the Romans *Albis*, by popular confusion with *albus*, white, and by the Bohemians *Labe*). An important river of central Europe, affording water communication from Austria and the interior of Germany to the port of Hamburg (Map: Germany, D 2). It originates in the confluence of numerous streams which rise at the southwestern base of the Schneekoppe, one of the highest summits of the Riesengebirge, a mountain range on the northeast border of Bohemia. Beginning near lat.  $50^{\circ} 45' N.$  at an elevation of 4400 feet above sea level, it has a total length of about 725 miles, of which about 525 miles are navigable. Its basin is estimated at 56,500 square miles. Through most of its course the Elbe is less than 1000 feet wide, but at its long estuary-like mouth it has a width of several miles. From the base of the Schneekoppe it flows south to Pardubitz, thence west to Kolin, and then in a generally northwesterly direction past Melnik, where it is 425 feet wide and becomes navigable for small boats. At Tetschen it leaves Bohemian territory, breaking through the Mittelgebirge and then the Erzgebirge at the only point in the Bohemian frontier below 1500 feet, and enters Saxony. Its principal affluent in Bohemia is the Moldau.

On its way northwest through Saxony the Elbe passes Pirna (where it becomes navigable for quite large boats), Dresden, and Meissen. Entering Prussian Saxony, it passes Wittenberg, from which point it flows first west, then northwest to Magdeburg (where it has a width of 800 feet), having received the Mulde and the Saale, both from the south. From Magdeburg flowing northeast the Elbe arrives at the border of Brandenburg, receiving the Havel from the southeast. Turning northwest, it enters Hanover, through which it flows for about 30 miles. Then, still coursing northwest and past Hamburg and Altona, the Elbe empties into the North Sea at Cuxhaven, where it attains a breadth of about 10 miles, and where the tide

risers 13 feet. Numerous islands divide the Elbe into several branches between Hamburg on the north and Harburg on the south. Ocean liners ascend to Hamburg, 60 miles from the sea. Navigation on the Elbe has been greatly improved by the application of modern methods. The river has been canalized for a distance of about 75 miles, dams constructed to deepen the channel, but in form in which they may be dropped flat at the bottom of the river in case of flood or frost, locks constructed, and conditions so improved that vessels of 800 tons are now used where only those of 250 tons could formerly operate. A "towing chain" has been laid at the bottom of the river from Hamburg to Aussig, Bohemia, a distance of over 400 miles. The chain, which is stationary in the bed of the river, passes over a revolving wheel or drum on the vessel, by which large boats loaded with merchandise are moved from Hamburg to the heart of Bohemia. A series of canals also connects the Elbe with the Oder, the Spree, and the Trave, the cost of the Elbe-Trave canal, 45 miles long, having been nearly 6 million dollars, borne chiefly by the Kingdom of Prussia and the state of Lubeck. The towns and cities along the 525 miles in which the river is navigable have expended large sums in the construction of harbors, wharves, docks, warehouses, and other facilities for the promotion of commerce, and the volume of merchandise now moved on the Elbe is many times that prior to the adoption of the improvements above noted, and exceeds that of any other river of Germany. The scenery of the valley of the Elbe, though generally pleasing, is not remarkable in any portion of its course except that between Aussig and Dresden. Here the bold and picturesque cliffs and other beautiful landscape features have given the district the name of "Saxon Switzerland." The Elbe is stocked with fine fish. Its commerce is very extensive and important. Consult: Semmler and Münnig, *Der Elbstrom von seinem Ursprung bis zu seiner Mündung* (Dresden, 1845); Bose, *Allgemeine geographische und hydrotechnische Beschreibung der Elbe* (Annaburg, 1852); Nehls and Bubenberg, *Die Elbe* (Hamburg, 1852); Zöllner, *Die Bedeutung der Elbe für den Mittelalterlichen Handel Sachsens* (Chemnitz, 1896); Linde, *Die Niederelbe*, 4th ed. (Leipzig, 1913).

**ELBE**, AUGUSTE VON DER. See DECKEN, AUGUSTE VON DER.

**ELBÉE**, əl'bā', MAURICE LOUIS JOSEPH GIGOT D' (1752-94). A Vendean general. He was born at Dresden and was of remote Scottish extraction. Upon the outbreak of the Revolution he was elected to the Constituent Assembly, but emigrated in 1791. He returned in 1792, and after the death of Cathelineau was proclaimed commander in chief of the "Catholic and Royalist army." After winning a succession of brilliant battles he was captured by General Thureau, condemned to death by a council of war, and shot.

**ELBERFELD**, əl'bər-fēlt. One of the most important manufacturing towns in Germany, situated on both sides of the Wupper, an affluent of the Rhine, in the Prussian Rhine Province, 16 miles east-northeast of Düsseldorf (Map: Germany; B-3). With the sister city of Barmen, which adjoins it, it forms a single industrial centre of 325,000. The old parts of the town are poorly built, their streets are irregular; but the

more recently erected portion is modern, with broad streets and imposing buildings. The Rathaus, the courthouse, many public squares with handsome monuments make the newer city attractive. Elberfeld is one of the centres of the textile industry. It has numerous establishments for the dyeing, weaving, and printing of cotton, silk, woolen, and mixed goods, and also manufactures of furniture, dyes, chemicals, iron and steel products, paper, carpets, beer, arms, leather, rubber goods, gold and silver ware, machinery, wall paper, and stained glass. Most of its textile industries date from the eighteenth century. The commerce of the town is extensive and there are a number of financial institutions and consular agents from many foreign countries. The educational institutions of the city include a gymnasium, a mechanics and polytechnic school, an industrial drawing school, and an institute of music. The city is noted for its poor-relief system, and is the headquarters of the Berg Bible Society. Elberfeld is an important railway centre and has seven stations. Electric street railway lines traverse the town and connect it with Barmen, while a suspended electric road follows the bed of the Wupper from Rittenshausen to Sonnborn. Eighteen bridges are thrown across the river to facilitate the immense traffic. Pop., 1900, 157,927; 1910, 170,195. Elberfeld grew up about a castle belonging to the family of Elverfeld, erected in the twelfth century, but was afterwards united with the Duchy of Berg. It obtained municipal privileges in 1610. Industrial prosperity began in the latter part of the eighteenth century through the introduction of silk weaving and Turkey-red dyeing. In 1815 it passed with Berg to Prussia. Consult: Schnell, *Geschichte der Stadt Elberfeld* (Elberfeld, 1900); A. Shadwell, *Industrial Efficiency* (London, 1906); Jorde, *Führer durch Elberfeld und seine Umgebung* (Elberfeld, 1902).

**ELBERFELD SYSTEM.** The manufacturing town of Elberfeld, Prussia, has become famous for its plan of relieving the poor. The reform began in 1800, when, dissatisfied with existing conditions, the city appointed six visitors to investigate applications for relief. The visitors were increased to 12 the following year. In 1802 there was a great increase. The city was divided into eight districts and these districts into four sections, and a board of supervisors chosen. The system was further extended in 1841. In 1850, dissatisfaction having arisen in several quarters, the Lutheran church attempted to do the work. Matters were not improved. In 1852 the present plan was proposed by a banker, Daniel von Heydt, and was put in operation. The city was divided into 364 precincts, and over each was placed an unsalaried almoner whose duty was to investigate each applicant for aid and to make visits every two weeks as long as aid was given. Fourteen precincts form a district. The almoners meet every two weeks under direction of an unpaid overseer to discuss the cases and to vote needed relief. These proceedings are reported to the directors, comprising the mayor as ex-officio chairman, four councilmen, and four citizens (also unpaid), who meet the day following and review and supervise the work throughout the city. In emergency cases the almoner may furnish assistance. Relief is granted in money according to a fixed schedule for two weeks at a time,

any earning the family may have being deducted. Tools are furnished when advisable. The system has given great satisfaction; the expenses in proportion to the population have gradually decreased, and the condition of the poor is said to have improved. The essential principles of the Elberfeld system have found application in the public-relief administration of the cities of the Rhineland, notably in Cologne, Crefeld, Düsseldorf, Aix-la-Chapelle, and Remscheid. A similar system has been employed in Hamburg since 1788; in 1792 the Hamburg plan was reorganized under Elberfeld influence. The same influence has been potent in the reorganization of relief systems in most of the German cities. Attempts to introduce the system in non-German cities have not met with marked success. See CHARITY ORGANIZATION SOCIETY; PAUPERISM.

**ELBERTON.** A city and the county seat of Elbert Co., Ga., 34 miles east by north of Athens, on the Seaboard Air Line and the Southern railroads (Map: Georgia, D 1). The city contains a public library and owns the water works and electric-lighting plant. It is in a cotton-growing region, and has a cotton factory, a cotton compress, a cottonseed-oil mill, fertilizer factories, harness, carriage and wagon shops, ironworks, granite quarries, etc. Pop., 1900, 3834; 1910, 6483.

**ELBEUF**, *él-bœf'* (Lat. *Elborium*). A modern cloth-manufacturing town in the Department of Seine-et-Marne, France, in a valley on the left bank of the Seine, 14 miles by rail from Rouen (Map: France, N., F 3). The two principal buildings are the churches of Saint-Etienne and Saint-Jean-Baptiste, both containing fine specimens of richly painted glass of the fourteenth and fifteenth centuries. It has schools of instruction in cloth manufacture and industry. There are numerous factories in Elbeuf and the suburban communes of Saint-Pierre-les-Elbeuf, Caudebec-les-Elbeuf, Orival, and Saint-Aubin-Jouste-Bouleng, principally of double-twilled and waterproof cloth, flannel fabrics, and light woollens of every color and description, which employ fully half of its inhabitants. Pop., 1906, 17,800; 1911, 18,290. Elbeuf had 80 cloth manufacturing factories as early as the sixteenth century, but when the Edict of Nantes was revoked the greater number of the cloth makers emigrated; and it was not till after the revolution of 1789, and later the separation of Belgium and France, that the industry revived.

**ELBING**, *él'bīng*. An important commercial town in the Prussian Province of West Prussia, on the navigable Elbing, about 5 miles from its mouth in the Frisches Haff, and 35 miles east-southeast of Danzig (Map: Prussia, H 1). It is connected by a canal with the Nogat, the eastern arm of the Vistula. The town was formerly surrounded by a wall, of which, however, but few traces remain. Among its manufactures are machinery, linen and cotton cloths, leather, tobacco, soap, chicory, lumber, flax and hemp yarn, as well as trade in agricultural products. There are also oil manufacturing, iron foundries, dye and print works, and the famous Schichau shipbuilding works for the construction of war vessels. Elbing has excellent railway facilities and is in steamboat communication with Danzig and Königsberg. Pop., 1906, 52,518; 1910, 58,636. It was founded about the beginning of the thirteenth century by colonists from Lübeck and Bremen, who settled about the fortress erected by the Knights

of the Teutonic Order. It early joined the Hanseatic League, but in 1454 came under Polish rule. It suffered severely from religious strife among its citizens and from the wars of Sweden, Poland, and Russia. In the first partition of Poland it was annexed to Prussia in 1772, and, after a period of decline, has again risen to a thriving condition.

**EL-BOSTAN.** See ALBISTAN.

**ELBOW.** See ARM.

**ELBOW-PIECES**, *COUDIÈRES*, or *COUDES* (Fr.). In mediæval armor, the metal plates used to cover the junction of the brassards and vambrace, by which the upper half and lower half of the arm were covered. They were of three principal kinds, disk-formed, cup-formed, and articulated, and were sometimes armed with spikes. In the fifteenth century they were sometimes fan-shaped and of enormous size. Consult Ashdown, *Arms and Armour* (New York, 1909).

**ELBRUZ**, *él-brōōz'*. The highest summit of the Caucasus Mountains (q.v.), and the loftiest peak in Europe (Map: Russia, F 6). It is situated in lat. 43° 21' N. and long. 42° 25' E. It is an extinct volcano with two craters, the mountain mass being composed of volcano rocks. Its elevation is 18,470 feet above sea level.

**ELBURZ**, *él-bōōrz'*. A mountain range in northern Persia, extending from the boundary of Persia and the Russian Province of Transcaucasia southeastward along the shores of the Caspian Sea, changing its trend near the southern limit of the latter to northeast towards the frontier of Turkestan (Map: Persia, D 3). The range marks the limit of the Iranian Plateau towards the Caspian depression and is a unit in the great mountain system that stretches from southern Europe eastward into Central Asia. The north slopes of the Elburz, receiving an abundant rainfall, are intersected by fertile valleys that support a rich tropical vegetation, while the south slopes are generally dry and almost barren. A single river, the Kizil Uzen, crosses the range to enter the Caspian Sea. There are several passes, of which the most important are those connecting Teheran with Amol and Balfrush, near the centre of the range, and, farther westward, that between Kasbin and Resht. The Elburz has an average altitude of about 5000 feet, the highest peak being Demavend with an estimated elevation of 19,000 feet.

**EL CANEY**, *él kă'nă*. A town of Cuba, 4 miles from Santiago de Cuba (Map: Cuba, K 6). Here on July 1, 1898, during the Spanish-American War, occurred an engagement between about 520 Spaniards, intrenched, under General Vara del Rey, and about 4500 Americans under General Lawton. The Spaniards made a desperate resistance, but were finally overcome by the American infantry. The Americans lost 443 in killed and wounded and missing, the Spaniards 420 (including 100 prisoners). Consult: Lee, "The Regulars at El Caney," in *Scribner's Magazine*, vol. xxiv (New York, 1898); Norris, "Battle of El Caney," in *The Century* (ib., 1899); Bonsal, "Battle of El Caney," in *McClure's*, vol. xii (ib., 1899).

**ELCANO**, JUAN SEBASTIAN DE. See CANO, JUAN SEBASTIAN DEL.

**ELCESAITES**, *él-sēs'ā-its*. See ELKESAITES.

**ELCHE**, *él'chă*. A town in the Province of Alicante, Spain, 16 miles southwest of the city of Alicante, on the river Ninalapo, about 2 leagues from the sea, and on the Alicante-Mur-

cia Railway (Map: Spain, E 3). The town is strikingly Oriental in appearance; its architecture in general has retained much of the Moorish character. Elche is well built and has several public squares, while it is partly surrounded by groves of date palms. The church of Santa Maria is an imposing edifice with a large dome and a tabernacle of precious marbles. Other important structures are the Casa Consistorial, bishop's palace, the hospital, and barracks. The dates gathered from the palm plantation are exported in considerable quantities; also the palm branches, which are used for religious purposes. P. . . . are extensively cultivated and . . . other important article of commerce. The chief manufactures include woollens, articles of esparto grass, brandy, wine, oil, soap, leather, etc. Pop. (commune), 1900, 27,430; 1910, 30,713. Elche, anciently called Illici or Ilici, was raised by the Romans to the dignity of a colony with the *jus Italicum*. It increased in importance under the Goths, as evidenced by its erection into an episcopal see, which, however, ended with the Moslem occupation. Excavations have brought to light objects of considerable archaeological interest. Of these perhaps the most exquisite piece is the terracotta bust of a Roman lady, now on exhibition in the Louvre.

An interesting fête occurs at Elche each summer from the 13th to the 15th of August and is well worth visiting despite the heat. These days are the fête of the Assumption, and are celebrated by Elche with a performance of the *Representation of the Assumption of Our Lady St. Mary*, a fourteenth-century liturgical, musical drama. The play is popularly known as the *Festa* (or *Misterio*) *de Elche*, but its real title is *Consuetud de la Festa de Nostra Señora de la Asumpcio que es celebra en dos Actes, Vespra y Dia, en la insigne villa de Elig, Escrita per un devot seu en VI dias del mes de febrer del año MDCCCXIX*. In its present form it is a seventeenth-century remodeling of a fourteenth-century Catalan drama on the same subject: *La representacio de la Asumpcio de Madona Sta. Maria*. As the theatre or stage for the performance is the whole city, we naturally compare it with the *Festspiel* of Rothenburg, *Der Meistertrunk*. But as it has a religious topic, one must compare it also, *mutatis mutandis*, with the *Passion Play* of Oberammergau. For the original play, consult the edition by Joan Pie, published in the *Revista de la asociacion artistico-arqueologica barcelonesa* (Barcelona, 1898), and reprinted, with another play, as *Autos sacramentales del siglo XIV* (ib., 1898), and the edition by the scholarly composer and musician Felipe Pedrell in the *Sammelbande der Internationalen Musik-Gesellschaft* (Leipzig, Jan.-March, 1910), which is the best edition and has a careful study of the sources and the musical score. For a sympathetic account of the whole festival, see Pierre Paris, "Les fêtes de l'Assomption à Elche (Espagne)," in *Le Correspondant*, vol 192, n.s., p. 156 (1898).

**ELCHINGEN**, el'king-en. A village of Bavaria, near the left bank of the Danube, about 5 miles northeast of Ulm. It is noteworthy as the scene of a battle fought on Oct. 14, 1805, between the French, under Ney, and the Austrians, under Laudon, which resulted in the defeat of the latter and the surrender of Ulm. Ney's victory obtained for him the title of Duc d'Elchingen.

**ELCHO, LORD.** See WEMYSS, ninth EARL OF. **EL'DAD AND ME'DAD.** 1. Two persons mentioned in Num. xi. 26-29 as prophesying, though not present with Moses and the 70 elders at the tent of the meeting when Yahwe gave His spirit. Joshua is said to have demanded that they be forbidden. But Moses himself is credited with a wish that all Yahwe's people were prophets. The story is held to belong to a late stratum of the Pentateuchal narratives and to reflect a tendency to look with more generous sympathy upon men of the spirit condemned as false prophets in leading Ephraimite circles, as is suggested by the hostile attitude ascribed to Joshua. The name of the second prophet is given as Modad by the Greek version. Both names are compounded with Dad, who may be identical with Hadad. In that case their meaning would probably be "Hadad is my god" and "Water of Hadad," i.e., "Seed" or "Offspring of Hadad." Targum Jonathan to Num. xi. 26 et seq. makes these prophets predict the death of Moses, the succession of Joshua to the leadership, the coming of the King of Magog, the victory over him, and the resurrection of Israel to take part in the meal when the bull Leviathan is to be served. The Fragment Targum makes Eldad and Medad prophesy the destruction of Gog and Magog through Messiah, the King.

2. An apocalyptic work ascribed to Eldad and Medad is quoted in the *Shepherd of Hermas*, Vis. ii, 3, 4. The quotation reads, "Near is the Lord to those who return." As Targum Jonathan quotes a similar expression of the two prophets, "Near is the Lord to those that are in the hour of need," it is not impossible that the author was familiar with the same work. In his *Chronographia Compendiaria*, Nicephorus gives a list of canonical and apocryphal books which contains this work and states that it has 400 stichi. This list is found also in the *Synopsis* ascribed to Athanasius. Lightfoot and Holtzmann think that the quotations in 1 Clem. xxii, 3, 4, and 2 Clem. xi, 2, have been drawn from the same source. Consult: Fabricius, *Codex Pseudepigraphus Veteris Testamenti* (Hamburg, 1722); Holtzmann, *Einführung in das Neue Testament* (Freiburg, 1892); Harnack, *Geschichte der altchristlichen Litteratur* (Leipzig, 1893); Zahn, *Geschichte des newtestamentlichen Kanons* (ib., 1890-92); Schürer, *Geschichte des jüdischen Volkes* (4th ed., ib., 1909); Funk, *Patres Apostolici* (Tübingen, 1901); Beer, "Eldad und Medad im Pseudojonathan," in *Monatschrift für Geschichte und Wissenschaft des Judentums*, 1857, pp. 316 ff.; Bardenhewer, *Geschichte der altkirchlichen Litteratur I* (Freiburg, 1913).

**ELDAD HA-DANI**, há-dā'nē, also surnamed Abu-Dani, David-had-Dani, or the Danite (ninth century). A Jewish traveler, who undertook two voyages for the purpose of tracing the history of the Lost Ten Tribes of Israel. He had many extraordinary adventures, which are recounted in a narrative afterward translated into several languages, including English (1855). But the account is so highly fabulous that it is impossible to tell what parts are true.

**EL'DER** (AS. *ealdor*, *aldor*, comp. of *eald*, *ald*, OHG., Ger. *alt*, old; connected with Goth. *alan*, Icel. *ala*, Lat. *alere*, to nourish, as an ecclesiastical title an exact translation of the Greek *πρεσβυτερος*, *presbyteros*, comparative of *πρεσβύς*, *presbys*, old, which occurs frequently in the New



Testament). The title of an office bearer in certain churches. 1. In the Old Testament it is a title generally indicating in the earlier history the chiefs of tribes and afterward men of special influence, dignity, and authority in their local community. In the Hebrew polity, as shown in the New Testament, the elders are the lay element in the Sanhedrin. It was a survival of the common early patriarchal system. 2. In the New Testament elder is also the title of certain officers in the newly organized society of Christians, corresponding to the rulers in the Jewish synagogues, who apparently exercised a considerable control in the conduct of the local churches. The office of elder developed very generally in the churches of the Reformation. In most of the churches on the continent of Europe which have any kind of connection with the state there is some regulation of the civil law with reference to the election and functions of elders. In some churches elders are appointed for a certain term of office; but more generally it is until death, resignation, removal from the bounds of the congregation, or deposition. The ordination of elders takes place in the congregation, but usually without the imposition of hands. In the Baptist churches the pastors of churches were formerly often called elders, although the term was specially applied to evangelists and missionaries. In the churches of the Presbyterian order the pastor of a church is technically called the *teaching elder*, as distinguished from the *ruling elders*, commonly called simply *elders*, who are a body of laymen varying in number, selected to assist the pastor in the oversight and government of the church. The board of ruling elders constitute with the pastor the session of the church and are intrusted with its government and discipline, subject to the supervision of the presbytery. Such elders are required to accept the symbol or confession of faith of the Presbyterian church; they do not administer the Sacrament, but may aid in the Lord's Supper by distributing the elements. They are sometimes elected for life, sometimes only for a term of years. In the Reformed churches (Dutch and German) the consistories include the ministers, elders, and deacons, and the latter two classes of officers are elected only for a term, with permission of reelection. In the early days of American Congregationalism many churches had in addition to a pastor and teacher a ruling elder charged with matters of church government and discipline. In the Methodist Episcopal church the presiding elder is an ordained clergyman appointed by and serving under the bishop, with large supervisory powers within a specified district. He presides over the quarterly and district conferences and visits the churches. Traveling elders are itinerant preachers appointed by the annual conference. In the Mormon church the elder is an officer whose duty it is "to preach and baptize; to ordain other elders, and also priests, teachers, and deacons, to lay on hands for the gift of the Holy Ghost, to bless children, and to take the lead at all meetings." These elders constitute the Melchizedek priesthood, and include the apostles, the seventy, the patriarchs, and the high priest. Among the Shakers four elders, two males and two females, have charge of each of the aggregated families.

**ELDER** (OE. *elder*, *eller*, AS. *ellen*, *elder-tree*): A tree or shrub of the genus *Sambucus*, which belongs to the family Caprifoliaceæ.

There are about 20 widely distributed species. The common elder of Europe (*Sambucus nigra*) is a large shrub or sometimes a small tree, with large compound leaves and dense cymes of cream-colored flowers. The berries are black, occasional sports bearing white berries, which have a subacid, sweetish, and, to many, an unpleasant taste. They are extensively made into wine and used to adulterate port wine. The wood is yellow; that of old trees is hard, tough, takes a fine polish, and is used as a substitute for boxwood. The young wood has a very large pith. The scarlet-fruited elder (*Sambucus racemosa*) is a native of the colder portions of the Northern Hemisphere. It resembles the common species except in having greenish-white flowers and scarlet berries. This species is very ornamental and is frequently planted in shrubberies. The dwarf elder or danewort (*Sambucus ebulus*) is a peculiar species occurring in Europe, northern Africa, and western Asia. In the United States the common elder (*Sambucus canadensis*) is a species greatly resembling the *Sambucus nigra* of Europe. The cymes of the flowers are flat-topped, and the berries, which are purplish black, are used for making wine and occasionally other preparations. This species is a very common shrub along roads and fences. The scarlet-fruited species occurs in rocky situations and seems to fruit most abundantly at the north or where the climate is cool. *Sambucus mexicana*, of the southwestern United States and Mexico, is a tree attaining a height of 25 feet or more, with a trunk 12 to 15 inches in diameter. It branches abundantly and makes a dense shade. Medicinal properties have been attributed to the bark and the leaves, and hydrocyanic acid has been found in the leaves, young shoots, and green berries. The dried flowers are used in medicine. They contain a volatile oil, resin, wax, tannin, pectin, etc., and possess stimulant, carminative, and diaphoretic properties. The fresh fruits are used in the home manufacture of a wine, and elder-flower water is a common preparation used in confectionery. A perfume is made by distilling water, elder flowers, and rectified spirits. The proportions used are 10 pounds of elder flowers, two gallons of water, and three ounces of spirits, from which mixture about one gallon is distilled. This distillate is used to flavor wines, jellies, etc. The young flower buds are sometimes pickled like capers. Numerous household remedies are prepared from different parts of the plants. A number of other plants are known by the name elder, as wild elder (*Aralia hispida*), marsh elder (*Iva imbricata*), box elder (*Acer negundo*), poison elder (*Rhus vernix*), etc.

**ELDER, JOHN** (1824-69). An English engineer and shipbuilder. He was born in Glasgow and was a son of David Elder (died 1866), who built the first marine engine in the establishment of Napier in 1822. He was educated in Glasgow and after directing the drawing office in Napier's establishment became a member of the firm which after 1860 was conducted under the name of Randolph, Elder & Co. and employed more than 4000 men. Elder is especially celebrated as the inventor of the compound or combined high and low pressure engines, in which the economy of fuel amounted to nearly 40 per cent.

**ELDER, WILLIAM HENRY** (1819-1904). An American prelate. He was born in Baltimore, was educated in that city and at the College of



the Propaganda, Rome, was successively professor in and president of Mount St. Mary's College, Emmitsburg, Md., and was consecrated Roman Catholic Bishop of Natchez, Miss., in 1857. For some time he was coadjutor to Archbishop Purcell, of Cincinnati, and upon the death of the latter prelate in 1883 was made his successor.

**ELDER STATESMEN.** A group of Japanese public men. See JAPAN, section on *History*.

**ELDEST SON OF THE CHURCH** (Fr. *Fils aîné de l'Eglise*). A title applied in former times to the King of France to show his relation to the church.

**EL/DON, JOHN SCOTT, EARL OF (1751-1838).** Lord High Chancellor of England and one of the greatest of English judges; born at Newcastle-on-Tyne, June 4, 1751. In 1766 he went to Oxford, where his brother was then a tutor, and entered University College. In 1770 he took his bachelor's degree and in 1771 gained the chancellor's prize for an English essay. A clandestine marriage with a Miss Surtees, the daughter of a Newcastle banker, not only lost him his fellowship and cut off his clerical prospects, but threatened for a time to throw him into mercantile life. However, his brother's influence was strong enough to prevent this, and by his advice John returned to the university, where he supported himself by tutoring and, in the meantime, devoted himself assiduously to the study of law. His legal studies covered a narrow range, being confined almost entirely to Littleton, Coke, and the law reports, but must have been of the most intense and thorough character. In the year 1776, in which he was admitted to the bar, the death of his father placed him in possession of a small but sufficient fortune. In 1783, after only seven years at the bar, he won the distinction of becoming a King's counsel and a bencher of the Middle Temple. In the same year he became a member of Parliament, where he supported the administration of the younger Pitt. Though not a natural orator, and though he never became a good debater, his great energy and the force of his intellect and character made him a valuable and influential member of Parliament and speedily gained for him political preferment. In June, 1788, he was made Solicitor-General and received the honor of knighthood.

In 1793 he was made Attorney-General and in that capacity conducted the famous state trials of the following year. In 1799 he was appointed Chief Justice of the Court of Common Pleas and was raised to the peerage with the title of Baron Eldon, of Eldon, and two years later he became Lord Chancellor of England and, with the exception of the year of the Grenville and Fox administration (1806-07), held that high office until 1827. The great dignity of the chancellorship and its close relations to the crown made it in Eldon's case as much a position of political as of legal authority and influence. The Chancellor of George III, of the Regency, and of George IV, who was at the same time the close friend and the most trusted adviser of the monarch, was practically the mainstay of the crown and government during that long period of Tory ascendancy. His share in the administration of affairs was scarcely disguised by the composition of the successive ministries whose policy he shaped and in whose behalf he used without scruple the great powers of his high office. In 1821, per-

haps as a reward for the part taken by him in the matter of the proposed divorce of the King, he was further honored with the dignity of Viscount Encombe and Earl of Eldon. On the advent of the Canning ministry in 1827 he resigned the great seal and retired to private life. Though not a lawyer of wide and extensive learning, knowing nothing of the Roman jurisprudence or of the civil law of modern Europe, his complete mastery of the common-law system and the subtlety and acuteness of his reasoning powers made him a common-law judge of the highest, or all but the highest, order. It is here that his name most securely rests. Though recognized also as one of the greatest of equity judges, the lack of precision and definiteness in the rules of equity jurisdiction, and the scope which it permitted to the administration of justice on conscientious grounds, proved an embarrassment to his logical mind. He was at his best when he had definite rules and binding precedents to follow or to evade by subtle distinctions. Though he by these very qualities contributed not a little to give definiteness and certainty to the equity system, he allowed the business of the Court of Chancery to fall so much in arrears as seriously to embarrass the administration of justice and to give the court the reputation for dilatoriness from which it still unjustly suffers. He survived his retirement from office for nearly 11 years, dying in London, Jan. 13, 1838. For his life consult: Twiss, *The Public and Private Life of Lord Eldon* (Philadelphia, 1844); Surtees, *Sketch of the Lives of Lords Stowell and Eldon* (London, 1846); Campbell, *Lives of the Lords Chancellors of England* (ib., 1874-75).

**EL/DORÁ.** A city and the county seat of Hardin Co., Iowa, 27 miles north by west of Marshalltown, on the Minneapolis and St. Louis and the Chicago and Northwestern railroads (Map: Iowa, D 2). Eldora contains a Carnegie library and a park, and the State Industrial School for Boys is near by. The city is in an agricultural and stock-raising region. Deposits of fire and brick clay, building stone, and a workable vein of good coal are near. The manufactures include brick, sewer and drain tile, lumber, flour, and foundry products. There are municipal water works. Pop., 1900, 2233; 1910, 1995.

**EL DORADO**, ɛl dō-rá/dō, *Sp. pron.* ɛl dō-rá/dō (Sp., the gilded). A term applied, first to a South American king said to cover his body annually with gold dust and bathe in a sacred lake, then to a fabled golden city, and finally to a fabled country abounding to an almost inconceivable degree in gold and precious stones. The legend, whose origin has never been satisfactorily accounted for, took many variant forms, while the mythical king and his equally mythical dominions were shifted with the utmost facility from one part of the continent to another. The story fired the imaginations of the gold-hungry Spaniards, who expended vast sums in sending out exploring parties, most of which returned decimated by privations, fatigue, and disease. The most celebrated expeditions were those of Diego de Ordaz (1531), whose lieutenant, Martinez, claimed to have visited a golden city, called Omoa, and to have been entertained by "El Dorado" himself; and of Orellana (1540-41). In 1595 Sir Walter Raleigh took up the search and described the city as on an

island in "Parima" Lake (in Guiana), which for over two centuries was put down on the maps. Milton's lines will be recalled:

"Guiana, whose great city Geryon's sons  
Call *El Dorado*."

*Paradise Lost*, vi, 410, 411.

The name has since been applied to any place abounding in gold or in opportunities for acquiring sudden wealth and, more specifically, to a county in California and a city in Colorado. In literature and especially in poetry frequent references have been made to the legend, the most celebrated of which is probably that in Voltaire's *Candide*, chaps. xvii, xviii. Consult: Markham, *Search for El Dorado* (London, 1861); Van Heuvel, *El Dorado* (New York, 1844); Von Langegg, *El Dorado* (Leipzig, 1888); Bandelier, *The Gilded Man* (New York, 1893); Peters, *Eldorado of the Ancients* (ib., 1902).

**EL DORADO.** A city and the county seat of Union Co., Ark., 30 miles south-southeast of Camden, on the Chicago, Rock Island, and Pacific, the El Dorado and Wesson, and the St. Louis, Iron Mountain, and Southern railroads (Map: Arkansas, C 4). It contains a courthouse and county jail. El Dorado is in a cotton and peach-growing region and has cotton oil, planing, and stave mills, railroad shops, bottling works, and a foundry. It was incorporated as a city in 1908. Pop., 1900, 1069; 1910, 4202.

**ELDORADO.** A city in Saline Co., Ill., eight miles northeast of Harrisburg, on the Cleveland, Cincinnati, Chicago, and St. Louis, the Illinois Central, and the Louisville and Nashville railroads (Map: Illinois, H.10). There are coal mines, bottling works, flouring mills, a machine shop and foundry, lumber yards, and manufactories of wire stretchers, wash boilers, medicines, candy, cigars, and brick and tile. Pop., 1900, 1445; 1910, 3366.

**ELDORADO.** A city and the county seat of Butler Co., Kans., 31 miles east by north of Wichita, on the Missouri Pacific, the Atchison, Topeka, and Santa Fe, and the Kansas City, Mexico, and Orient railroads, and on the Walnut River (Map: Kansas, F 7). It carries on a large trade in grain, live stock, and farm and dairy products, and has machine shops, carriage works, and limestone quarries. Eldorado was settled in 1858 and incorporated in 1870. It contains a Carnegie library. The water works are municipally owned. Pop., 1900, 3456; 1910, 3129.

**ELDORADO SPRINGS.** A city in Cedar Co., Mo., 100 miles southeast of Kansas City, on the Missouri, Kansas, and Texas Railroad. There are mineral springs with medicinal properties, the bottling of whose water constitutes the chief industry. Farming and stock raising are also carried on. The city owns its water works. Pop., 1900, 2137; 1910, 2503.

**ELD'S DEER;** also called **BUEMESE**, or **BROWN ANTLER, DEER.** A rusine deer (*Cervus eldi*) of the Malayan region and the island of Hainan. It is about 4 feet in height and frequents open swampy regions, often gathering into large bands and resembling the Indian swamp deer in habits. It has a unique form of antler, the brow tine curving down over the forehead in a long sweep and the upper part consisting of many short points. Its native name in Burma is *thamyn*. It is one of the rarest of deer in captivity, and specimens have been obtained

only by sending special expeditions to northern Burma. It breeds freely, however, in the Zoological Park in New York City. Consult Lydekker, *Deer of All Lands* (London, 1898).

**ELE'AN, ERE'TRIAN, or ELEAN-ERE-TRIAN SCHOOL.** One of the Socratic schools. It was founded by Phædo (q.v.) at Elis and transplanted by Menedemus to Eretria. We know less of this school than of any of its rivals, the Cyrenaic, the Cynic, and the Megaric schools (qq.v.), to the last named of which it approximated in its doctrines. Consult Zeller, *Socrates and the Socratic Schools* (London, 1877).

**ELEANOR** (ē'l'e-nēr) **CROSSES.** The name given to 12 crosses said to mark the stages in the funeral journey of Eleanor, wife of Edward I of England, from Grantham to London, where she was buried in Westminster Abbey. Of these crosses, not all of which are memorial crosses, those at Geddington, Northampton, and Waltham are preserved. See **CHARING CROSS**.

**ELEANOR OF AQUITAINE**, āk'wī-tān' (c.1122-1204). A queen of France and afterward of England. She was the granddaughter of William IX, Duke of Aquitaine, and succeeded her father in 1137. She was married in the same year to Louis VII of France. Her lively and somewhat frivolous disposition and her love for pleasure did not fit her for the society of a husband who was naturally austere, and who from religious conviction had adopted many ascetic haunts. In the Holy Land, whither she accompanied him in 1147, her conduct was scandalous; finally a divorce was pronounced under the pretext of kinship in 1152. Eleanor soon gave her hand and possessions to Henry Plantagenet, who in 1154 mounted the throne of England as Henry II. In 1170 Eleanor induced Henry to invest their son, Richard the Lion-Hearted, with her personal dominions and aided him in his rebellion against Henry II in 1173. Consequently she was placed in confinement, where she remained till the death of her husband (1189). As soon as he died she regained her liberty and reigned as regent until Richard's arrival from France. She also held this position during Richard's absence in the Holy Land, which began in 1190. She continued to be prominent in public affairs, whenever need arose, until she retired to the abbey of Fontevault, where she died, April 1, 1204. By Louis VII she had two daughters; by Henry, five sons and three daughters. Two of her sons, Richard and John, became kings of England; and two of her daughters queens, one of Castile and the other of Sicily. Consult: Ramsay, *Angvin Empire* (London, 1903); Norgate, *England under the Angevin Kings* (ib., 1887); Davis, *England under the Normans and Angevins* (ib., 1905); Adams, *History of England, 1066-1216* (ib., 1905).

**EL'EATIC SCHOOL.** The group of ancient Greek philosophers usually reckoned as beginning with Xenophanes (q.v.), but more properly beginning with Parmenides of Elea, a Greek city of lower Italy, and including Zeno, likewise of Elea, and Melissus of Samos. In opposition to the physical philosophy of the Ionic school (q.v.) and to the doctrine of Heraclitus (q.v.), who asserted that everything is flux, the Eleatic philosophers maintained that the only true reality is changeless being. All change and process and difference are empty illusions. The senses, as furnishing us with a changing con-

tent, are of no value for knowledge. Thought is the organ of knowledge. Indeed, thought and being are not identical. Consult the histories of philosophy by Zeller, Windelband, and Gomperz; also Burnet, *Early Greek Philosophy* (London, 1892). See PARMENIDES; ZENO.

**ELECAMPANE** (Fr. *enule-campane*, ML. *inula campana*, from Lat. *inula*, elecampane, *campus*, field). A genus of plants of the family Compositæ, nearly allied to *Aster*. The only important species is the common elecampane (*Inula helenium*), a native of damp meadows in the middle and south of Europe, rather rare in the British Isles. It is naturalized in America and has spread extensively. This plant, which is a coarse, stout perennial with large yellow flowers, was formerly much cultivated for its root, which was used in medicine, and still retains its place in the pharmacopœias, although comparatively neglected. The root has a faint aromatic odor and a bitter, acrid, and somewhat camphor-like taste. It acts as a gentle stimulant to the organs of secretion, promotes expectoration, and is diuretic and sudorific. It contains inulin, which is closely related to starch, but gives a yellowish instead of a blue color with iodine. The root also contains a peculiar principle called helenin or elecampane camphor, which resembles camphor in some of its properties. A number of species are cultivated for their abundant yellow or orange-colored flowers, which appear early in the summer. For illustration, see Plate of EDELWEISS.

**ELECTION** (Lat. *electio*, choice, from *eligere*, to choose, from *e*, out + *legere*, to select). As a legal term, the choice, or the right or duty to choose, between two inconsistent alternative rights or benefits. These rights may be accorded by contract, as when a purchaser of property stipulates for the option of paying in money or in other property; or when an insurance company reserves the option of paying the sum for which a building is insured or of rebuilding it. Still more frequently persons are put to an election by a rule of law or of equity. A person whose property has been wrongfully taken may sue the wrongdoer for the value of the property in a court of law, or he may bring an action in tort for the conversion; but he is not entitled to pursue both remedies.

The doctrine of election in equity is said to have its origin in two inconsistent alternative gifts or benefits, one of which the giver has no power to make without, at least, the assent of the donor of the other gift. For example, A gives to B property belonging to C, and by the same instrument—generally a will—gives to C property belonging to A. Here C is put to an election between keeping his own property and rejecting A's gift, or accepting A's gift and turning over to B his (C's) property. This doctrine rests upon the intention of A as disclosed by the whole instrument. That intention clearly is that C shall not receive the gift named for him, unless he accedes to the gift named for B. Another example of election is that to which a widow is frequently put between her right of dower (q.v.) and an inconsistent benefit bestowed by her husband's will.

Election may be made by an express and formal announcement, or it may be, and more frequently is, implied from the conduct of the one entitled or bound to elect. In either case an election is not conclusive, as a rule, unless made with knowledge of all material facts necessary

to an intelligent choice. When made with such knowledge, it is irrevocable. Consult the authorities under WILL; DOWER.

**ELECTION**. In theological language, the divine act by which certain individuals are chosen to salvation in Christ. As expressed in the Articles of Religion of the Church of England, election is the decree of "God's everlasting purpose, whereby He hath constantly decreed by His secret counsel to deliver from curse and damnation those whom He hath chosen in Christ out of mankind, and to bring them by Christ to everlasting salvation as vessels made to honor."

Although the expressions "election," "elect," etc., are frequent in Scripture, it cannot be said that what is known as the theological doctrine of election was acknowledged by the Christian Church till the time of Augustine (q.v.). The controversy between Pelagius and Augustine in the beginning of the fifth century brought out almost all the aspects of the question which have since, at successive epochs in the history of the Church, risen into renewed prominence. The contests between the Scotists and Thomists in the fourteenth century, between the Arminians and Calvinists, and, within the Roman church, between the Jansenists and Molinists in the seventeenth century, are recurring expressions of the same radical conflict or divergency of opinion. Two forms of the doctrines have been held: one, that the election of God is governed by His foreknowledge of man's action; the other, that election is governed only by the absolute will of God. The former of these opinions corresponds to the Pelagian or Arminian doctrine of election, the latter to the hyper-Augustinian or Calvinistic. In the view of the Arminian salvation is within the choice of the human will; in the view of the Calvinist the human will is of little or no account—the decree of God is everything—and this decree (which Calvin admitted to be a *decretum horribile*) absolutely determines some to everlasting life and some to everlasting death. The separation has its source in the will of God and not in the moral conditions of mankind. In the one case election depends upon the foreknowledge by God of faith on the part of the elect; in the other, faith itself proceeds from grace and is thus conditioned upon election, which is therefore the ground of the foreknowledge of faith. This question is evidently the question of "prevenient grace" (see GRACE), for election is only the eternal purpose in respect to grace. See FOREKNOWLEDGE AND FOREORDINATION.

**ELECTION**, in politics, is the choice of public officers by the vote of those who are entitled to exercise the elective franchise. This is to be distinguished, on the one hand, from the appointment of officers by a superior, as by a king, a president, a governor, or a mayor; and, on the other hand, from their selection by lot. The last-named method of choosing public officers was considered by Aristotle one of the characteristic features of a popular government. It has been advocated by other writers, because of its tendency to prevent the formation of political parties. Party organization, the caucus, the coalition of different factions, the corruption of voters, the falsification of election returns, the interest of a particular candidate, and kindred evils, it is argued, will all be swept away if officers are selected by lot.

When officers are chosen by the great body of the voting population, the election is spoken of as *popular* or *direct*. This is the prevailing form in free government at present. It had its origin in the general assemblies of primitive states, such as the Roman Concilia, the Athenian Ecclesia, the Teutonic Assembly of Free-men. After the establishment of the Roman Empire popular election became a farce and finally disappeared as a political institution of the Roman state. It was continued, however, in the ecclesiastical government of the Christian Church and reappeared throughout Europe in the guilds of all kinds, whose members chose their officers, as well as in the free towns, whose citizens elected their municipal officers to attend to local affairs and their representatives to take part in the deliberations and legislation of parliaments or the States-General. Election is said to be *indirect* or *representative* when it is limited to a comparatively small body whose members have themselves been chosen by the general mass of electors. Elective monarchs have usually been selected in this way. Examples may be found in the case of the former kings of Poland and Hungary and of the head of the old German Empire. At times the choice of candidates for kingship has been limited to a certain family, while the right of voting was exercisable by all the free-men. Such appears to have been the early practice of most Teutonic states. As a state enlarges, this practice is generally modified. Dr. Stubbs tells us that the election of the King in Anglo-Saxon England in form and substance, to the extent exercised by that body in the general assemblies of the whole nation. A striking example of indirect or representative elections in our time was afforded by the choice of United States Senators by the legislatures of the various States from the adoption of the Constitution until the ratification in 1913 of the Seventeenth Amendment. In theory the President of the United States is selected by the presidential electors chosen in each State. In practice, however, these electors cast their votes for the party candidate.

Another classification of elections is based upon the governmental functions of the offices to which persons are chosen. An election is *national* which has for its object the selection of national officers, such as members of the United States House of Representatives, who are chosen every two years, and the President and Vice President, who are chosen every four years. It is styled a *State* election when held for the choice of State officers, such as Governor, Lieutenant Governor, and members of the State Legislature. If the political duties of an officer are confined to a particular subdivision of the State, such as a town, a city, or a county, his election is known as *municipal*.

Any fraudulent act tending to defeat an honest, free, fair, and pure election is a criminal offense at common law. Various statutes have been passed in almost every State for the express purpose of securing to voters entire freedom of action and of preventing improper practices in voting, in receiving votes, in counting votes, and in registering the results. The validity and regularity of elections are not infrequently disputed, and such disputes present important questions for the courts or for special tribunals. Of the latter class, the most

famous in the history of this country is the Presidential Electoral Commission of 1877, constituted of five Senators, five members of the House of Representatives, and five associate justices of the United States Supreme Court, which decided the contest between Tilden and Hayes. By the Federal Constitution each House of Congress is the final judge of the election of its members, and a similar provision relating to the State is found in most of the State constitutions. It must be confessed that in cases of contested election in Congress or State legislatures purely partisan considerations have in great measure affected the decision. Contested parliamentary elections in Great Britain are determined by the courts and not by the House of Commons.

Election officers, whether inspectors at the various voting precincts or members of a county or State board of canvassers, perform merely ministerial functions. They are not judicial or quasi-judicial officers. Their duty is to do the acts prescribed by statute and not to pass judgment upon disputed questions. If they go beyond their ministerial duties and attempt to exercise judicial functions, they subject themselves to an action for damages by any person legally wronged, as well as to criminal punishment. Consult: *People vs. Board of Canvassers*, 129 N. Y. 371-372; *People vs. Rice*, 129 N. Y. 465-466; Aristotle, *Politics*, ed. by Weldon (London, 1883); Freeman, *Comparative Politics* (ib., 1873); Woolsey, *Political Science* (New York, 1877); Stanwood, *Presidential Elections* (1892); Wilson, *Australian Ballot System* (Boston, 1884); New York State Legislature, *Report of Joint Committee Appointed to Investigate Primary and Election Laws in New York and Other States* (Albany, 1910); Jones, *Readings on Parties and Elections in the United States* (New York, 1912). See BALLOT; ELECTORAL REFORM; SUFFRAGE; VOTE.

**ELECTION, PRIMARY.** See PRIMARY ELECTION.

**ELECTION CAKE.** A rich loaf cake which, in the days when Connecticut held an annual election, formed an important part of the refreshments offered to visitors to its State capital.

**ELECTION COMMITTEE.** See CONGRESS, UNITED STATES.

**ELECTIVE AFFINITIES.** A term expressing an old conception of the cause of chemical changes. According to that conception, if a given substance is brought into contact with two other substances, with either of which it is capable of combining, it will enter into combination with the one for which it has the greater affinity. Elective affinity was thus supposed to be the sole determining factor of chemical changes. At present this idea is known to be false, or rather to require very important limitation. "Affinity," while one of the factors determining the course of chemical change, is not the only factor, the active masses of substances and the temperature being known to have a definite influence in all cases. See BERGMAN; BERTHOLLET; AFFINITY, CHEMICAL; REACTION; ELECTROCHEMISTRY; THERMOCHEMISTRY.

**ELECTIVE COURSES** and **ELECTIVE STUDIES.** Terms that have come into common use during the last 30 or 40 years in American colleges, and to a great extent in establishments for secondary education, to indicate the

studies which may be elected or chosen by undergraduate students. The principle has been imitated to some degree in the secondary schools of Europe, especially those of France. In earlier days there was a required curriculum which must be followed by all candidates for the degree of B.A. At a later period, to meet the special needs or wishes of individuals, certain studies were made "optional"—modern languages, e.g., the higher branches of mathematics, botany, surveying, and other scientific or technical branches. The rapid growth of science and the resources of the colleges were increased by enlargement of the teaching forces and by provision for instruction in subjects before neglected. Choice became imperative. To a considerable extent this necessity was recognized and satisfied by the foundation of technical or scientific schools, sometimes departments of or annexes to the old colleges, sometimes independent establishments. Gradually the old curriculum, often called the regular college course, yielded to the same influences. A few institutions still adhere, with commendable pride, to the theory of a liberal education based upon the classics and mathematics—antecedent to the time-honored baccalaureate degree. Yet the American colleges generally offer in these days a very considerable freedom in the selection of subjects to which the student may devote his time. There are certain inherent dangers in this freedom. The love of ease may lead to the selection of courses—which are called "soft" in college parlance—exactng but little mental effort; or the ignorance and inexperience of youth may lead to selections which will be regretted in mature life. To obviate such dangers, it is common to lay before the students "groups" of subjects which form a good combination. With more or less emphasis these groups are commended to students. As a further guide to the wise selection of subjects, members of a faculty are always ready to give advice, and in some places those teachers who are most interested in pedagogics are officially recognized as "advisers"—a term which seems to have been introduced to supersede that of tutors, who were regarded rather as disciplinarians than as counselors. On the whole, the establishment of elective courses marks a propitious advance in higher education. The system works well wherever due care is exercised by the authorities to secure industry, application, and concentration. The University of Virginia was a pioneer in the provision of electives. Most of the State universities are now thoroughly committed to the principle. The older colleges, led by Harvard, have adopted it to a greater or less extent. The new foundations—Cornell, Johns Hopkins, Chicago, and Leland Stanford Junior—have never felt the fetters of a traditional curriculum.

The exact position of any college can be ascertained only by reference to its latest announcements, for changes frequently occur in the subjects offered and in the technical requirements for degrees. Consult: Butler, *Education in the United States* (Albany, 1900); Eliot, *Educational Reform* (New York, 1898); W. T. Foster, *The Administration of the College Curriculum* (Boston, 1911); *The Educational Review* (New York, 1891 et seq.). See COLLEGES, AMERICAN; UNIVERSITY; and the various institutions.

**ELECTORAL COLLEGE.** In the political system of the United States, the body of electors in each State who have been chosen to select the President and Vice President. The expression does not appear in the Constitution or statutes, but is a popular designation of the electors, adopted by analogy to the college of cardinals, to which the choice of the popes is committed. It is sometimes employed of the whole body of electors for President and Vice President, chosen by all the States. The Constitution prescribes (Art. II; and Amendments, Art. XII) the number of electors and the manner in which they shall exercise their high functions, but leaves to the States the mode of appointing them and to Congress the power to determine a uniform time for choosing them and the day on which they shall give their votes. Accordingly the members of the electoral college in each and every State are chosen simultaneously by popular vote on the Tuesday next after the first Monday in November. Their number is equal to the whole number of Representatives which the State sends to both branches of Congress. They are required to meet at some place designated by the Legislature of their State on the second Monday in January, and then and there to vote by ballot for President and Vice President, of whom one, at least, shall not be a resident of the same State with themselves. Each electoral college then makes a list of the names of all its candidates for President and Vice President, with the number of votes for each; the list is signed and certified by every member of the college, is authenticated by the Governor of the State, and transmitted to the President of the Senate of the United States. On the second Wednesday in February the electoral votes are opened and counted in presence of both Houses of Congress, assembled in the chamber of Representatives, and the result is announced by the President of the Senate. The persons who receive the highest number of votes, respectively, for the offices of President and Vice President are declared elected, provided they have received a majority of all the votes. In case of a tie the House of Representatives, voting by States, each State having one vote, is to choose between the equal candidates for President, a majority of all the States being necessary to a choice. The Senate has the power to choose in case of a tie in the vote for Vice President. In the same way, in case there is no tie, but the leading candidates fail to receive a majority of all the votes, the election for President is thrown into the House, and that for Vice President into the Senate. Under the Constitution as originally framed the electoral colleges did not designate their choice for President or Vice President, but when the total votes were counted by the President of the Senate, the candidate receiving the highest number of votes was declared to be elected President, and his nearest competitor Vice President. But the Twelfth Amendment to the Constitution, adopted in 1804, changed the mode of voting for the two officers, the electors being required to vote separately for President and Vice President.

The present position and functions of the electoral college furnish a striking illustration of the way in which a written and stable constitution may be undermined and amended by the silent process of customary observance. It is obvious that the Constitution contemplates that

the electoral college in each State shall be a deliberative body, freely exercising an untrammelled choice for the high offices which they are called upon to fill. They are not required, nor are they expected, to vote as a unit, still less to meet for the sole purpose of registering a result which has already been reached elsewhere and by others. That this remarkable change in the conception of the constitutional functions of the electoral college has been brought about is due to the course of our political development, and particularly to the national-convention system of nominating candidates for the presidency and vice presidency. These conventions are not within the Constitution, nor have they any legally binding force. But the electors, subsequently nominated and elected for the sole purpose of giving the vote of the State to a certain party candidate, are as securely bound to that course of action by custom and honor as they would be by statute. The people, consequently, elect the President and Vice President by States, and the college is a cumbrous machine for formally conveying to Washington the wishes of the majority. Since 1801, with one exception (the disputed election of President Hayes in 1877), the vote of an elector has been known with certainty several weeks before it is cast and several months before it is officially announced. The electoral system has constantly endangered the State, on account of the absence, until recently, of any general law to govern the President of the Senate in his canvass of the votes, and the tendency of Congress to decide every case of doubt or disputed returns arbitrarily as it arose. As a result of the Hayes-Tilden election contest, a law was passed (approved February 3) to cover the contingency of rival electoral colleges and disputed returns. Under the terms of this act each State is conceded to have the right of determining all controversies or contests regarding the appointment of its own presidential electors; and in case of any such contest Congress is to accept the State's settlement of the same as conclusive, and it cannot reject any electoral vote, duly certified, unless both Houses concurrently decide that that vote has been irregularly given. If more than one return from a State is received, only those votes are to be counted which the State itself has indorsed as regular; but if the State has been unable to settle the question, owing to its having two or more rival sets of authorities, or from any other cause, then the two Houses are to decide the dispute. See CONSTITUTION OF THE UNITED STATES; CONVENTION; PRESIDENT; and the authorities there referred to.

**ELECTORAL COMMISSION.** In United States history, the body of men provided for by an Act of Congress, approved Jan. 29, 1877, to settle certain disputed questions in regard to the electoral votes of several States in the presidential election of 1876. As the counting of the electoral votes in the presence of the two Houses of Congress proceeded according to custom, it had been found that there were conflicting certificates from four different States—Florida, Louisiana, Oregon, and South Carolina; and the two Houses were unable to agree in any case which certificate should be received as genuine. The Senate at the time was controlled by the Republican party, the House of

Representatives by the Democratic party, and there was thought to be danger of civil disturbances on account of certain questions likely to arise in the counting of the electoral votes. Under these circumstances a majority of each of the two political parties in Congress agreed to create a commission to be composed of five Senators chosen by the Senate; five members of the House of Representatives, chosen by that body; and five associate justices of the Supreme Court, four of whom were designated by the act of Congress, and the fifth of whom was to be selected by the four—to which commission should be referred, for judgment and decision, the question which of two or more conflicting certificates received from any State of the votes cast by the electoral college of such State for President and Vice President in the election of 1876 was the certificate provided for in the Constitution of the United States. The judgment of the commission in any matters referred to it, unless set aside by the concurrent action of the Houses of Congress, was to be final. The proposed law was thereupon enacted, and the Senate appointed three Republicans and two Democrats, and the House of Representatives three Democrats and two Republicans, as members of the commission. Of the four associate justices of the Supreme Court who were named in the law, two were understood to be Democrats and two Republicans; and these selected as the fifth associate justice to serve with them upon the commission, Mr. Justice Bradley, a Republican, the only member not selected avowedly as a partisan. The commission was constituted as follows: Justices Clifford, Strong, Miller, Field, and Bradley; Senators Edmunds, Morton, Frelinghuysen, Thurman, and Bayard; and Representatives Payne, Hunton, Abbott, Garfield, and Hoar. Upon the illness of Senator Thurman his place was filled by the choice of Senator Kernan. The certificates and returns were successively referred to the commission, which proceeded to hear argument upon the questions involved. A notable group of distinguished lawyers participated in the conduct of the case, William M. Everts, Stanley Matthews, E. W. Scribner, and Samuel J. May representing the Republicans, and S. Black, Matthew H. Carpenter, Charles O'Connor, J. A. Campbell, Lyman Trumbull, Ashbel Green, Montgomery Blair, George Hoadley, William C. Whitney, R. T. Merrick, and A. P. Morse representing the Democrats. The result in the case of each State was a decision of the commission, by a vote of 8 to 7—the vote following the line of party division in the body—that the certificate of the electoral votes cast for Hayes and Wheeler, the Republican candidates for President and Vice President, was the certificate which contained the lawful electoral vote of said State, and that the other certificates were illegal and void. The Republican Senate concurred in this judgment in each case, while the Democratic House of Representatives dissented. The decision of the commission, therefore, according to the terms of the statute, became irrevocable; the electoral votes were counted accordingly; and Rutherford B. Hayes and William A. Wheeler were found duly elected, by a majority of one electoral vote, respectively President and Vice President for a term of four years, from March 4, 1877. The controlling question before the commission was whether—an electoral certificate being in form according to law, as



those in favor of the Republican candidates were—it was competent for Congress or the commission to go behind the same and take evidence modifying or explanatory (*aliunde*) in support of alleged irregularities and frauds committed before such certificate was issued. For the choice of Republican electors in Louisiana had been accomplished only by the rejection of several thousand Democratic votes by a Republican returning board. Upon this question the Democrats in Congress and in the commission took the affirmative, while the Republicans took the negative. There can hardly be a question that Mr. Tilden was morally entitled to the presidency. The full proceedings of the commission were published as part iv, vol. v, of the *Congressional Record* of 1877. Consult: Rhodes, *History of the United States from the Compromise of 1850*, vol. vii (New York, 1906); Haworth, *The Hayes-Tilden Disputed Presidential Election of 1876* (Cleveland, 1906); Burgess, "The Law of the Electoral Count," *Political Science Quarterly*, vol. iii (1888).

**ELECTORAL REFORM.** In general, any improvement by law or custom in the manner of elections to public office. Specifically, describes the movement of the last 100 years for the purification of elections in Great Britain and the United States.

It is of the utmost importance, in a state whose government rests wholly or in great part on popular suffrage, that public elections should be free and honest. When they are of this character, public officials are true representatives of the people, and the legislation and policies which such officials adopt fairly reflect the popular will. The tendency, however, in every representative government is towards the control of nominating conventions and of elections by small bodies of men whose energies are chiefly directed to the manipulation of caucuses and party machinery. While the great mass of electors are engrossed in the conduct of their private affairs, these professional politicians, taking advantage of the popular apathy, dictate nominations to office, force party conventions to register their secret choices, and control the entire machinery of elections.

Accordingly agitation for electoral reforms has usually been directed towards one of three ends: (1) a change in the qualifications of electors; (2) securing to electors the free and effective expression of their choice of officers; (3) the punishment of those guilty of corrupt practices in connection with elections.

1. **Qualifications of Electors.** Both in Great Britain and in the United States the state has treated the elective franchise as a privilege of its citizens, and not as one of their natural rights. Hence it has bestowed that privilege from time to time upon those, and those only, who it has been considered would use it wisely and for the best interests of the state. Public opinion concerning the proper qualifications of voters has undergone many changes during the last 100 years. In the main these have been in the direction of extending the franchise to new classes of voters, of broadening the basis of the electorate. When the United States became independent, suffrage was limited in every one of the commonwealths to property owners. In Massachusetts it was required not only that the voter be of age, but that he be the owner of real estate worth £60 sterling, or of a freehold yielding £3 annual income. In New York it

was necessary that he be seised of a freehold worth £20, or pay a rent of 40 shillings a year, and have his name on the list of taxpayers. South Carolina insisted upon the voter being a white freeman and freeholder and believing in the existence of a God and in a future state of rewards and punishment.

During the last century, however, most of the States accepted the theory of universal manhood suffrage, and extended the elective franchise to all male citizens of 21 years and upward, while a few of the States have granted to women also the privilege of voting. Although the tide of electoral reform in this country has set mainly in the direction of universal suffrage, in some States its purpose has been to impose restrictions upon the elective franchise. California, e.g., has enacted that no person who is unable to read the State constitution in the English language and write his name shall ever exercise the privilege of a State elector. Connecticut and Massachusetts impose somewhat similar restrictions upon voters. Several of the Southern States have recently limited the suffrage by imposing educational qualifications upon voters or by requiring them to pay certain taxes. This policy has for its prime object the disqualification of ignorant negroes. In Louisiana persons are not entitled to vote who do not possess the prescribed qualifications, provided they were entitled to vote on Jan. 1, 1867, or are sons or grandsons of persons thus entitled. The class thus excepted includes poor and illiterate whites. In some other Southern States the same end is effected through the imposition of qualifications as to property and from which veterans, Federal and Confederate, of the Civil War, as well as of earlier wars of the United States, are exempt. The chief reliance in the greater part of the South for the exclusion of the negro vote consists in the administration of property and literacy tests general in their terms.

Such restrictions as now exist upon male suffrage have given rise to very little popular agitation in recent years, although periodical motions are introduced in Congress to inquire into restrictions upon the negro vote in the South. Chief interest in the reform of suffrage qualifications centres in the question of woman's suffrage. Since 1869 women have voted on equal terms with men in Wyoming. They possessed full suffrage, in 1914, in eight other States. See WOMAN SUFFRAGE.

In Great Britain the trend of electoral reform has followed the same general course as in the United States, although it has not yet reached the goal of universal manhood suffrage. The electorate has been extended several times, until it includes not only copyholders, leaseholders, and householders of premises of small values, but also men occupying lodgings of the yearly value of £10. As in the United States, interest in electoral reform centres chiefly in the question of woman suffrage (q.v.).

2. **Protection of Voters.** It is of prime importance that perfect freedom of choice should be secured to electors. Hence the secret ballot has been substituted for the viva voce vote (see BALLOT), and bribery and intimidation of electors are treated as grave criminal offences. Not only should the elector be allowed to exercise his free choice at the polls, but that freedom ought not to be rendered ineffective by the improper manipulation of caucuses or primaries, or by

giving to the voters of some districts undue advantage over others. The caucus or primary is a meeting of the members of a particular political party or group for the purpose of nominating candidates for office within a prescribed district, or of electing delegates to larger conventions of the party, or of declaring party principles. These gatherings have often been controlled by unscrupulous persons, who have not hesitated to resort to fraud and violence. In order that the party caucus or primary should reflect the views of the majority of the party electors of the district, statutes have been enacted in several States surrounding those voluntary gatherings with many of the legal safeguards which protect general elections. The place and time for the caucus or primary are fixed by law, the manner of registration and voting is prescribed, and severe criminal penalties are affixed to fraudulent or violent manipulations of these meetings. In most States primary laws apply only to State and local elections. A few States, however, have laws providing primary elections for presidential candidates also, and in 1912 the presidential primary was employed in several States through the action of the party organization.

While this legal regulation of the primary has done much to mitigate its evils, it is still open to the objection that it leaves the control of the nominating system in the hands of the party managers and practically excludes the independent voter from exercising any considerable influence in the selection of candidates for public office. The recent increase in the number of independent voters has given them new weight in politics, and they are now demanding a further reform, which has in contemplation the substitution of "direct" for primary and caucus nominations. This is to be effected by permitting a specified number of voters to place a candidate in nomination by a written declaration signed by them, and without the intervention of the machinery of caucuses and conventions now employed. Several Western States have laws favoring direct nominations, but since these laws do not interfere with party tickets, their chief effect has been to facilitate the candidacy of independents without seriously impairing party control. A device that has recently been introduced for the purpose of reducing party influence over elections is that of preferential voting. By this device the voter registers not only his first choice, but his second, third, etc., for each elective office. If no candidate has a majority of first choices, second choices are canvassed and given full weight in determining the outcome. Various devices for determining the relative preference of the voters are in use. The plan in its various modifications is in use in West Australia (1907), South Africa (1909), Grand Junction, Colo. (1909), Spokane (1911). Several other cities have adopted the plan. See MUNICIPAL GOVERNMENT.

A flagrant example of the control of elections by corrupt party managers was formerly afforded by the pocket and rotten boroughs of England, which were disfranchised by the Reform Bill of 1832. These were boroughs (having the right to elect members of Parliament) that were controlled by nonresident noblemen, either by reason of their landed proprietorship or of their purchase of the electors. In many of them the number of voters was very small. For example, the borough of Gatton had but seven electors,

and that of Old Sarum but one—the keeper of an alehouse. When Lord Russell introduced his Reform Bill in 1831, 90 members of Parliament were returned by boroughs with less than 50 votes each, and a borough of 10,000 voters returned 2 members. The House of Commons was elected by 15,000 out of 3,000,000 male adults. One peer controlled boroughs which sent up 11 members of his choice to the House of Commons, while some of the great manufacturing centres had no representation in Parliament. The Reform Bill disfranchised 56 of these rotten boroughs and made a new distribution of parliamentary representatives throughout the kingdom.

The Fifteenth Amendment to the Federal Constitution provides that "the right of the citizens of the United States to vote shall not be denied or abridged by the United States or by any State on account of race, color, or previous condition of servitude," and vests Congress with power to enforce this provision by appropriate legislation. The Fourteenth Amendment prescribed, as the penalty for the abridgment of the right to vote by a State, reduction in the representation in Congress of that State. Although several States have in effect deprived negro citizens of the right to vote, Congress has enacted no legislation to enforce this constitutional provision.

**3. Corrupt Electoral Practices.** The most heinous of these are false personation and repeating by voters, and bribery and intimidation by candidates for office or their partisans. Both in Great Britain and in the United States repeated efforts have been made by legislators to eradicate these practices, but without entire success. Perhaps the most comprehensive and rigorous piece of legislation of this sort is the British Corrupt Practices Act of 1883, with its amendments. Its principal features are: (1) the severe penalties inflicted upon those guilty of false personation at the polls or of voting more than once at the same election, as well as upon all who indulge in the intimidation, undue influence, or bribery of voters; (2) the restriction within very narrow limits of the employment of paid agents, clerks, messengers, and others by candidates or election committees; (3) the prescribing of a fixed scale of lawful expenditures by candidates and committees; (4) requiring a full and correct account of such expenditures. Several of the United States have laws of a similar character. Although none of them are as sweeping or as effective as the British act, their results have been beneficial.

Some of the grosser forms of fraud at elections, such as the use of fraudulent and tissue ballots and the stuffing of ballot boxes, have been rendered obsolete by the adoption of the Australian ballot, and the assumption by the State of the duty of furnishing an official ballot in place of the party ballot formerly provided by the several party organizations.

The provision for the retirement of an elective officer before the expiration of his term of office, known as the "recall," has been widely discussed and has gained headway in the last few years. By this plan a petition signed by a certain proportion of the voters in the previous election can bring about another election to determine whether an accused officer shall be retained or another elected. The plan was first officially adopted in the Los Angeles charter of 1902. The device was soon adopted by a considerable number of California cities. In 1908 the recall was adopted by State constitutional amendment

in Oregon. California (1911) and Arizona (1912) also amended their constitutions to provide for the recall. The device has been widely adopted in city charters. See **RECALL**.

Within the last few years a movement known as the "short ballot" has made considerable headway, especially in connection with the commission form of government for towns and cities. (See **MUNICIPAL GOVERNMENT**.) This is an attempt to reduce the number of elective officers by reducing the offices to be filled at one election to a reasonable number. The idea of this plan is to simplify the voters' task and thus make possible a more intelligent and more honest use of the ballot. See **BALLOT**; **CORRUPT PRACTICES**; **ELECTION**; **VOTING MACHINE**; **INITIATIVE AND REFERENDUM**. Consult: Bishop, *Colonial Elections* (New York, 1893); Dallinger, *Nominations for Elective Office* (ib., 1897); Stürcks, *Primary Election Legislation* (ib., 1898); Ward, *Treatise on the Law Relating to Parliamentary and Municipal Elections* (2d ed., London, 1886); Wilson, *The State* (New York, 1909); id., *Constitutional Government in the United States* (ib., 1908); Commons, *Proportional Representation* (ib., 1907); *Loose Leaf Digest of Short Ballot Charters* (ib., 1911); Bacon and Wyman, *Direct Elections and Law Making by Popular Vote* (Boston, 1912).

**ELECTORAL VOTES.** The votes cast by presidential electors in the United States for the presidential and vice-presidential candidates. The candidates for the two offices were not voted for separately until after 1805, before which time the candidate receiving the largest total number of votes at any given election was declared President, and the one receiving the next largest number the Vice President. The electoral votes cast in the various campaigns since 1789 have been as follows: In 1789: George Washington, 69; John Adams, 34; Samuel Huntington, 2; John Jay, 9; John Hancock, 4; Robert H. Harrison, 6; George Clinton, 3; John Rutledge, 6; John Milton, 2; James Armstrong, Edward Telfair, and Benjamin Lincoln, each, 1. In 1793: George Washington, 132; John Adams, 77; George Clinton, 50; Thomas Jefferson, 4; Aaron Burr, 1. In 1797: John Adams, 71; Thomas Jefferson, 68; Thomas Pinckney, 59; Aaron Burr, 30; Samuel Adams, 15; Oliver Ellsworth, 11; George Clinton, 7; John Jay, 5; James Iredell, 3; Samuel Johnston, George Washington, and John Henry, each, 2; Charles C. Pinckney, 1. In 1801: Thomas Jefferson and Aaron Burr, each, 73; John Adams, 65; C. C. Pinckney, 64; John Jay, 1. In 1805: for *President*, Thomas Jefferson, 162; C. C. Pinckney, 14; for *Vice President*, George Clinton, 162; Rufus King, 14. In 1809: for *President*, James Madison, 122; C. C. Pinckney, 47; George Clinton, 6; for *Vice President*, George Clinton, 113; Rufus King, 47; John Langdon, 9; James Monroe, 3; and James Madison, 3. In 1813: for *President*, James Madison, 128; De Witt Clinton, 89; for *Vice President*, Elbridge Gerry, 131; Jared Ingersoll, 86. In 1817: for *President*, James Monroe, 183; Rufus King, 34; for *Vice President*, Daniel D. Tompkins, 183; John E. Howard, 22; James Ross, 5; John Marshall, 4; Robert G. Harper, 3. In 1821: for *President*, James Monroe, 231; John Q. Adams, 1; for *Vice President*, Daniel D. Tompkins, 218; Richard Stockton, 8; Daniel Rodney, 4; Robert G. Harper, Richard Rush, each, 1. In 1825: for *President*, John Q. Adams, 84; Wil-

liam H. Crawford, 41; Andrew Jackson, 99; Henry Clay, 37; for *Vice President*, John C. Calhoun, 182; Nathan Sanford, 30; Nathaniel Macon, 24; Andrew Jackson, 13; Martin Van Buren, 9; Henry Clay, 2. In 1829: for *President*, Andrew Jackson, 178; John Quincy Adams, 83; for *Vice President*, John C. Calhoun, 171; Richard Rush, 83; William Smith, 7. In 1833: for *President*, Andrew Jackson, 219; Henry Clay, 49; John Floyd, 11; William Wirt, 7; for *Vice President*, Martin Van Buren, 189; John Sergeant, 49; William Wilkins, 30; Henry Lee, 11; Amos Ellmaker, 7. In 1837: for *President*, Martin Van Buren, 170; William H. Harrison, 73; Hugh L. White, 26; Daniel Webster, 14; Willie P. Mangum, 11; for *Vice President*, Richard M. Johnson, 147; Francis Granger, 77; John Tyler, 47; William Smith, 23. In 1841: for *President*, William H. Harrison, 234; Martin Van Buren, 60; for *Vice President*, John Tyler, 234; Richard M. Johnson, 48; Lyttleton W. Tazewell, 11; James K. Polk, 1. In 1845: for *President*, James K. Polk, 170; Henry Clay, 105; for *Vice President*, George M. Dallas, 170; Theodore Frelinghuysen, 105. In 1849: for *President*, Zachary Taylor, 163; Lewis Cass, 127; for *Vice President*, Millard Fillmore, 163; William O. Butler, 127. In 1853: for *President*, Franklin Pierce, 254; Winfield Scott, 42; for *Vice President*, William R. King, 254; William A. Graham, 42. In 1857: for *President*, James Buchanan, 174; John C. Frémont, 114; Millard Fillmore, 8; for *Vice President*, John C. Breckinridge, 174; William L. Dayton, 114; A. J. Donelson, 8. In 1861: for *President*, Abraham Lincoln, 180; John C. Breckinridge, 72; Stephen A. Douglas, 12; John Bell, 39; for *Vice President*, Hannibal Hamlin, 180; Joseph Lane, 72; Herschel V. Johnson, 12; Edward Everett, 39. In 1865: for *President*, Abraham Lincoln, 212; George B. McClellan, 21; for *Vice President*, Andrew Johnson, 212; George H. Pendleton, 21. In 1869: for *President*, Ulysses S. Grant, 214; Horatio Seymour, 80; for *Vice President*, Schuyler Colfax, 214; Frank P. Blair, Jr., 80. In 1873: for *President*, Ulysses S. Grant, 286; Thomas A. Hendricks, 42; B. Gratz Brown, 18 (Horace Greeley having died in November, 1872); Charles J. Jenkins, 2; David Davis, 1; for *Vice President*, Henry Wilson, 286; B. Gratz Brown, 47; G. W. Julian, A. H. Colquitt, each, 5; J. M. Palmer, T. E. Bramlette, each, 3; W. S. Groesbeck, W. B. Machen, N. P. Banks, each, 1. In 1877: for *President*, Rutherford B. Hayes, 185; Samuel J. Tilden, 184; for *Vice President*, William A. Wheeler, 185; Thomas A. Hendricks, 184. In 1881: for *President*, James A. Garfield, 214; Winfield S. Hancock, 155; for *Vice President*, Chester A. Arthur, 214; William H. English, 155. In 1885: for *President*, Grover Cleveland, 219; James G. Blaine, 182; for *Vice President*, Thomas A. Hendricks, 219; John A. Logan, 182. In 1889: for *President*, Benjamin Harrison, 233; Grover Cleveland, 168; for *Vice President*, Levi P. Morton, 233; Allen G. Thurman, 168. In 1893: for *President*, Grover Cleveland, 277; Benjamin Harrison, 145; J. B. Weaver, 22; for *Vice President*, A. E. Stevenson, 277; W. Reid, 145; J. G. Field, 22. In 1897: for *President*, William McKinley, 271; William J. Bryan, 176; for *Vice President*, Garret A. Hobart, 271; Arthur Sewall, 149; Thomas E. Watson, 27. In 1901: for *President*, William McKinley, 292; William J. Bryan, 155; for *Vice President*, Theodore Roosevelt, 292; A. E. Stevenson, 155. In 1904: for *President*

Theodore Roosevelt, 336; Alton B. Parker, 140; for *Vice President*, C. W. Fairbanks, 336; H. G. Davis, 140. In 1908: for *President*, William H. Taft, 321; William J. Bryan, 162; for *Vice President*, James S. Sherman, 321; John W. Kern, 162. In 1912: for *President*, Woodrow Wilson, 435; Theodore Roosevelt, 88; William H. Taft, 8; for *Vice President*, Thomas R. Marshall, 435; Hiram Johnson, 88; Nicholas M. Butler, 8. Consult: McClure, *Our Presidents* (New York, 1905); Stanwood, *History of the Presidency, from 1788 to 1897* (Boston, 1898, 1912); *History of the Presidency from 1897 to 1912* (ib., 1912).

**ELECTORS**, GERMAN IMPERIAL (Lat., from *eligere*, to choose). In the Holy Roman Empire, the college of lay and ecclesiastical princes in whom the right of choosing the King of the Romans was vested. With the extinction of the Carolingian line after the breaking up of the Empire of Charles the Great, the kingship in Germany became elective, the right of election residing in certain of the great feudatories, though just in whom or on what grounds is not clear from the early mediæval accounts. An electoral body is vaguely mentioned in chronicles of 1152, 1198, and 1230. The electoral college was first clearly defined in 1356 in the Golden Bull, a constitution for the Holy Roman Empire, issued by the Emperor Charles IV. This document also prescribed the exact form and manner of election of the "King of the Romans and future Emperor." Its statements seem to indicate that the right of election had been attached to certain hereditary offices in the Imperial Court, as each prince elector is associated with such an office. The electors were the Archbishop of Mainz (Mayence), Arch-Chancellor of the Holy Empire for Germany; the Archbishop of Cologne, Arch-Chancellor for Italy; the Archbishop of Treves (Triers), Arch-Chancellor for the Gallic Provinces and Arles; the King of Bohemia, Arch-Cupbearer; the Count Palatine of the Rhine, Arch-Steward; the Duke of Saxony, Arch-Marshal; and the Margrave of Brandenburg, Arch-Chamberlain. The German Princes held that an election as King of the Romans by the German electors was also an election as Holy Roman Emperor; but the popes contended that they alone, as vicars of God, could bestow the Imperial dignity. The Peace of Westphalia (1648) created an eighth electorate for the heirs of the Count Palatine, Frederick V, who had been despoiled of his electorate in behalf of the Duke of Bavaria in the Thirty Years' War. A ninth, that of Brunswick-Lüneburg, was created in 1692, and fully established in 1710, as the electorate of Hanover. In 1777 the inheritance of Bavaria by the Elector Palatine restored the number to eight. In 1803, just before the dissolution of the Holy Roman Empire, the number was increased. From the fifteenth century the electors constituted a separate college in the Imperial Diet. Consult Bryce, *The Holy Roman Empire* (London, 1892). The Golden Bull is translated in Henderson, *Select Historical Documents of the Middle Ages* (ib., 1892). See HOLY ROMAN EMPIRE.

**ELECTRA** (Lat., from Gk. Ἠλέκτρα). In Greek legend: 1. The daughter of Agamemnon and Clytemnestra, and the sister of Orestes and Iphigenia. While Agamemnon was absent at the siege of Troy, his cousin Egisthus corrupted Clytemnestra and, on the great leader's return, assisted her in murdering him. Electra, alarmed

for the safety of Orestes (q.v.) and desiring to have in him an avenger, contrived to send him to his uncle Strophius, King of Phocis. There he met Pylades and formed with him the friendship so famed in story. By Pylades Electra was mother of Strophius and Medon. Her experiences are recounted by Æschylus in the *Choëphoroi*, by Sophocles in *Electra*, by Euripides in the three dramas *Electra*, *Orestes*, and *Iphigenia among the Tauri*, by Racine in *Electra*, and by Goethe in *Iphigenie auf Tauris*. Consult the introduction to the edition of Sophocles' *Electra*, by Jebb (Cambridge, 1894). 2. One of the Pleiades, daughter of Atlas and Pleione, and mother, by Zeus, of Dardanus (q.v.).

**ELECTRICAL ENGINEERS**, AMERICAN INSTITUTE OF. This is a national engineering society, with headquarters in New York, organized in 1884. Its objects are to advance the theory and practice of electrical engineering and the arts and sciences connected with the utilization of electricity. The total membership, Jan. 31, 1914, was 7705, classified thus: honorary, 4; fellows, 432; members, 1009; associates, 6260. Meetings are held monthly in New York, and at various times in 30 principal cities of the United States and Canada where sections are maintained, and at 47 institutions of learning in the United States and Canada where branches have been organized. The institute publishes the *Proceedings* (monthly) and the *Transactions* (annually).

**ELECTRICAL MACHINE** (from *electric*, from Lat. *electrum*, Gk. ἤλεκτρον, *elektron*, amber; connected with ἠλέκτωρ, *ēlektōr*, bright sun, Skt. *arka*, sun, from *arc*, to shine). An instrument which generates electricity by friction or by the inductive action of one set of conductors on another. It is believed that the earliest-known form was that of Otto von Guericke, which is described and illustrated in his work *Experimenta Nova* (Amsterdam, 1672), a drawing from which is reproduced in Fig. 1. It consisted of a ball of sulphur mounted on an axle which could be revolved. The dry hand of the experimenter was placed in contact with the

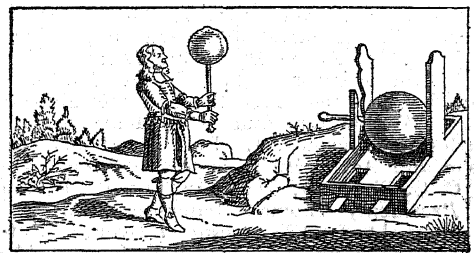


FIG. 1. VON GUERICKE'S ELECTRICAL MACHINE.

sulphur sphere, which was electrified by the friction thus developed. In Gravesande's *Physices Elementa* (1720) is described an electrical machine where the ball of sulphur is replaced by a hollow glass sphere which is rotated by means of cords or belts connected with a wheel and crank. In this apparatus threads are provided which are attracted to the charged sphere to show its electrification. In 1744 the electrical machine was improved by Bose, of Wittenberg, who introduced a metallic conductor, by means of which the electricity could be conducted from the sphere to the earth and produce a spark on its way. In the same year Winkler, of

Leipzig, devised a machine with a cylinder of glass instead of a sphere and substituted for the hand two pieces of wool or leather to rub against the glass. Subsequent developments in the eighteenth century included devices to rotate the cylinder, collecting combs or conductors with points, the use of amalgam on the rubbing surfaces, and, finally, the substitution of a disk of glass for the cylinder and sphere previously employed.

In its simple form the frictional machine, as these early pieces of apparatus were termed, is shown in Fig. 2. The glass disk is electrified by the friction of the rubber and the silk flaps, and a positive charge on the glass is produced, which escapes at the rings or points to the prime conductor, where it can be used to charge a Leyden jar or perform other experiments, while the negative charge produced on the rubber passes to the ground. Nearly all forms of frictional machines have been rendered

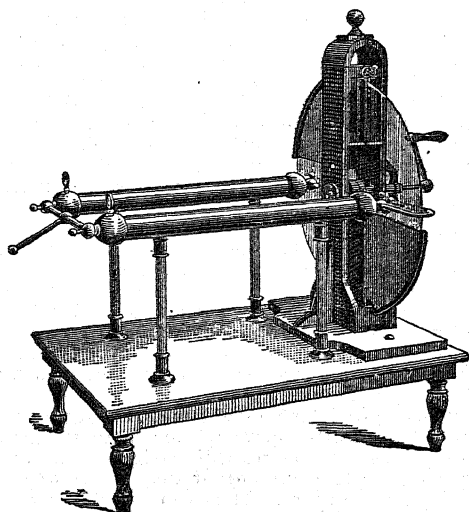


FIG. 2. SIMPLE FRICTIONAL MACHINE.

obsolete and their place taken by influence machines, whose action is far more effective and is less dependent on the dryness of the atmosphere. Of the influence machines which are extensively used, those of Töpler, Wimshurst, and Holtz, with improvements added by other physicists and instrument makers, are the leading types. Their action is based on the principle of the electrophorus (q.v.), where a charged body is used to charge a conductor which is under its influence. If a conducting body is brought near a substance which is electrified and then is touched so that a path of escape is provided for electricity of the same nature as the original charged body, a charge is communicated to the conductor. The influence machine accomplishes this automatically instead of requiring contact to be made with the finger, as in the case of the electrophorus. In the Töpler machine there are two glass plates, one of which is capable of revolution and is provided with a number of pieces of tinfoil attached to its surface, with small buttons of metal in the centre of each, while the other disk is fixed and has cemented to it two pieces of tinfoil, which are termed field plates. A slight charge is given to one of these field plates, and the movable disk is then re-

volved so that when one of its tinfoil disks, or carriers, comes opposite the field plate, it is charged inductively, since contact is made by a brush of fine brass wire which permits the

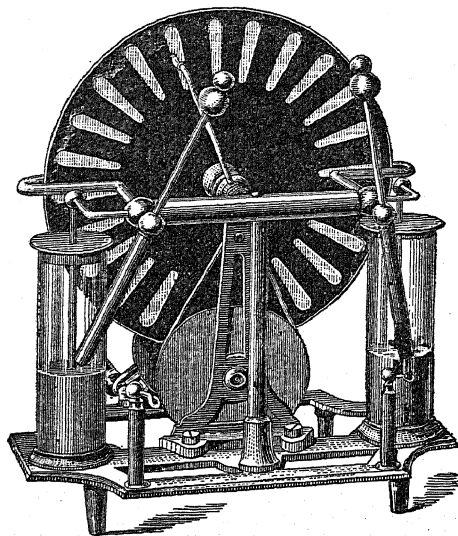


FIG. 3. WIMSHURST INFLUENCE MACHINE.

escape of the electricity of the same kind as the charge of the field plate. The carrier thus charged then passes the collecting combs, where it communicates to them a portion of its charge, and is then discharged by a neutralizing brush similar to that with which contact was first made and connecting with the field plate, thus increasing its charge. The same process takes place at opposite side of the plates; only the kind of electricity is changed, with the result that the process is continuous. The electricity from the collecting combs passes to Leyden jars, where it is collected. In the Wimshurst machine, which is shown in Fig. 3, both plates are movable, revolving in opposite directions. Each plate carries a series of tinfoil sectors which not only

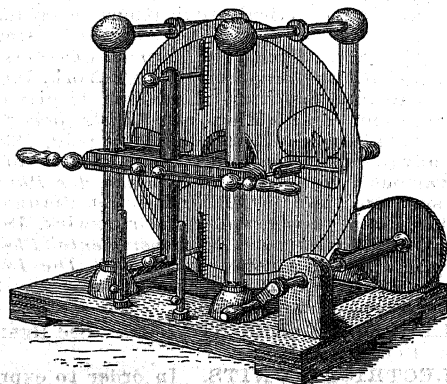


FIG. 4. HOLTZ ELECTRICAL MACHINE.

serve as carriers of the charges, but also as inducing plates. The brushes and collecting combs possess essentially the same functions as in the Töpler machine. In the Holtz machine, shown in Fig. 4, there are two glass plates, one of

which is solid and mounted on an axle capable of revolution, while the second plate is fixed and has a central opening through which the axle passes, and two windows through which pointed strips of paper project so that they are in contact or nearly in contact with the revolving plate. Below the window on the fixed plate are attached two pieces of varnished paper connected with the points, which serve as field plates, and opposite to these plates on the farther side of the revolving disk are the collecting combs. One field plate is charged by contact with an electrified body, such as a piece of hard rubber, and the electricity of the same kind, in this case negative, is driven from the opposite side of the revolving plate at the combs, leaving the glass plate with a positive charge. The plate thus charged revolves and the charge is brought opposite the field plate on the other side. Here negative electricity is drawn from the combs, leaving that knob of the prime conductor with a positive charge, while a positive charge is also given to the field plate. The inductive effect becomes greater as the disk is revolved, and as a result we have one set of field plates and the combs and conductors opposite them charged positively, while the others are negatively charged. The knobs of the conductors are at first in contact, but after a few revolutions of the disk they may be separated and a series of sparks produced whose length can be increased as long as the difference of potential is sufficient to overcome the air gap.

In a number of these electrical machines plates of rubber or vulcanite are substituted for glass disks; and the effect is also intensified by increasing the number of disks carried on the same axle, together with the combs, conductors, and other appliances. In the best of these machines sparks over a foot in length are obtained. In electrical machines, as in the case of all apparatus where electricity at high potential is used, the greatest care must be observed in insulating the different parts and conductors. Particularly, all glass parts on which the moisture of the atmosphere is likely to settle must be covered with shellac, varnish, or paraffin. Electrical machines are available for many experiments in static electricity, but save for igniting gas jets and for use in electrotherapeutics they have few practical applications in ordinary life. They will be found described in a simple manner in S. P. Thompson, *Elementary Lessons in Electricity and Magnetism* (New York, 1902). An interesting historical discussion is given in Gerland and Traumüller, *Geschichte der physikalischen Experimentierkunst* (Leipzig, 1899). The advanced student may consult with profit the various volumes of the *Annalen der Physik*, and such treatises as Müller-Pouillet Pfaundler, *Lehrbuch der Physik*, vol. iii (Brunswick, 1888-90); Wüllner, *Lehrbuch der experimental Physik* (Leipzig, 1895); Gustav Wiedeman, *Die Lehre von der Electricität* (Brunswick, 1882-85). See ELECTRICITY; ELECTROPHORUS.

**ELECTRICAL RESISTANCE.** See RESISTANCE, ELECTRICAL.

**ELECTRICAL UNITS.** In order to express by numbers the amounts of the different electric and magnetic quantities, various units or standards of comparison are necessary. They are all based upon the definition of a unit electrical charge and of a unit magnetic pole.

The C. G. S. Electrostatic System starts with the following definition: A unit electric

charge is such a one that, if two particles of matter, placed in a vacuum at a distance of one centimeter apart, are each charged with a unit charge, the force of action of one on the other will be one dyne. Based on this definition are the following units: Two points are at a unit difference of potential if it requires one erg to carry a unit charge from one point to the other. The capacity of a condenser is unity if, when charged to a unit difference of potential, there is a unit charge on each plate of the condenser. A unit current is such that, if it flows for one second, an electric charge equal to unity is carried. On this unit current all the magnetic quantities could be based.

The C. G. S. Electromagnetic System starts with the following definition: A unit magnetic pole is such that, if two such poles are at a distance apart of one centimeter in a vacuum, the force of action of one on the other is one dyne. On this definition is then based that of a unit electric current; viz., it is such a current that, if it is flowing through a linear conductor bent in the form of a circle of radius  $r$  cm., the force on a unit magnetic pole placed at the centre of the circle is  $2\pi/r$ , where, as usual,  $\pi = 3.14159$ . A unit quantity is, then, the charge carried by a unit current in one second, and to this can be referred units of potential and capacity; a unit electromotive force between two points is such that it requires one erg to carry a unit quantity between them, or if a unit current is flowing between them an amount of energy equal to one erg is set free in one second; a linear conductor of unit resistance is such that, if a unit electromotive force is applied at its ends, a unit current will be produced; a unit of induction is the induction in a circuit when the electromotive force induced in this circuit is unity while the inducing current varies at the rate of a unit current per second.

Experiments have established the connection between the units for the same quantity in the two systems. Knowing this ratio for any quantity, e.g., electric current, it may be at once deduced for the others. It is thus established that

Electrostatic unit	Electromagnetic unit
of quantity or current	= of quantity or current $\div v$
of potential or E.M.F.	= of potential or E.M.F. $\times v$
of capacity	= of capacity $\div v^2$

where  $v = 3 \times 10^{10}$ , or 30,000,000,000, very approximately. This is the same number as that expressing the velocity of light, and it should be according to the electromagnetic theory of light, which identifies the luminiferous ether with the medium serving for the propagation of disturbances due to electric oscillations. See LIGHT; ELECTRICITY.

These C. G. S. electromagnetic and electrostatic units are, in nearly every case, of inconvenient magnitude for practical purposes; and, further, their definitions are not such as lead easily and directly to methods of measurement. Consequently certain so-called "practical units" have been adopted which are of convenient magnitude and bear simple relations to the absolute units so far as possible. The following are these practical units, as defined at the London Conference of 1908: The unit of resistance shall be what is known as the international ohm, which is substantially equal to 1,000,000,000 units of resistance of the centimeter-gram-second system of electromagnetic units, and is represented by the resistance offered to an unvarying



electric current by a column of mercury at the temperature of melting ice, 14.4521 grams in mass, of a constant cross-sectional area, and of the length of 106.3 centimeters. (This would require a cross section of 1.00003 square millimeters, according to the accepted value for the density of mercury.) One million ohms, i.e.,  $10^6$  ohms, is called a megohm.

The unit of current shall be what is known as the international ampere, which is 0.1 of the unit of current of the centimeter-gram-second system of units, and is the practical equivalent of the unvarying current, which, when passed through a solution of nitrate of silver in water, in accordance with standard specifications (see AMPERE), deposits silver at the rate of 0.001118 of a gram per second. One thousandth of an ampere is called a milliampere.

The unit of electromotive force shall be what is known as the international volt, which is the electromotive force that, steadily applied to a conductor whose resistance is one international ohm, will produce a current of an international ampere, and is practically equivalent to  $\frac{100000}{100000}$  of the electromotive force between the poles or electrodes of the cell known as a normal cadmium Weston cell, at a temperature of  $20^\circ \text{C}$ ., and prepared in the manner described in the standard specification. See VOLT.

The unit of quantity shall be what is known as the international coulomb, which is the quantity of electricity transferred by a current of one international ampere in one second. See COULOMB.

The unit of capacity shall be what is known as the international farad (see FARAD), which is the capacity of a condenser charged to a potential of one international volt by one international coulomb of electricity. One-millionth of a farad is called a microfarad.

The unit of work shall be the joule, which is equal to 10,000,000 units of work in the centimeter-gram-second system, and which is practically equivalent to the energy expended in one second by an international ampere in an international ohm.

The unit of power shall be the watt, which is equal to 10,000,000 units of power in the centimeter-gram-second system, and which is practically equivalent to the work done at the rate of one joule per second. One thousand watts is called a kilowatt.

The unit of induction shall be the henry, which is the induction in a circuit when the electromotive force induced in this circuit is one international volt, while the inducing current varies at the rate of one ampere per second. Consult *Circulars of the United States Bureau of Standards* (Washington, D. C.). See HENRY.

**ELECTRIC ARC.** The effect produced when an electric current is maintained between two electrodes or terminals at a gap or opening in the circuit. This phenomenon involves the production of light and the generation of heat, and consequently the arc is employed for purposes of illumination as well as for producing high temperatures. The arc is distinguished from a spark in that the latter is of extremely brief duration and has a disruptive character, whereas in the case of the arc the vapor produced by the volatilization of the extremity of the electrodes is raised to a high temperature and forms a path across which a continuous discharge takes place. Sir Humphry Davy in 1800 exhibited to the Royal Institution apparatus where a continuous

spark was produced in a gap between two pointed pieces of charcoal, whether they were in air, or in water, or some other liquid. In 1808 Davy, by using a battery of 2000 elements, produced an arc nearly 4 inches in length. In 1843 carbon conductors formed from gas coke instead of charcoal were made use of by Foucault, and later various substances were introduced into the carbons in order to increase the length of the arc and make it more steady.

The first essential of an arc is an electric current of sufficient tension to force its way across the gap or opening where the arc is to be produced. Unless there is a very large difference of potential on both sides of the gap, there must first be contact between the two carbons or other electrodes while the current passes, and then after they have been separated the arc will be produced. As the terminals are separated, a minute spark is produced, and a part of the carbon or other material is volatilized and made conducting. The heat thus produced is so intense that it is necessary to employ electrodes of a highly refractory material in order to prevent their melting or too rapid vaporization, and it is for this reason that use is made of carbon terminals. The arc can be produced by either an alternating or direct current from a battery or dynamo. A pressure of about 45 volts is required to maintain an arc between carbons in the open air; if the carbons are inclosed so as to prevent the escape of the carbon vapor formed, as in the modern inclosed arc lamps, a pressure of about 75 volts is required. The current varies with the size of the carbons, in commercial practice about 10 amperes for the open arc and 6.5 amperes for the inclosed type. The carbons, when used for lighting, are generally placed vertically one above the other, and the positive carbon is distinguished by the formation of a crater, which is the most brilliant source of light as well as the place of most intense heat, being at a temperature of about  $3500^\circ \text{C}$ . (Violle). The negative carbon takes a pointed shape, but is consumed only one-half as rapidly as the positive. Both carbons are incandescent at their tops, and from these sources considerable light is emitted, though about 85 per cent of the total amount comes from the crater just mentioned. The arc itself furnishes only about 5 per cent, while the remaining 10 per cent comes from the negative carbon. The arc is affected by the magnetic influences, and the bow-shaped arc is produced with vertical carbons by the action of the earth's magnetism. It was from this curved appearance that the arc took its name. Many interesting effects take place in the arc, one of which is the change from carbon to graphite experienced in the electrodes of arc lamps. The composition of the light furnished by the electric arc varies with the material of the electrodes and even with different qualities of carbon. However, the light in general resembles sunlight, but is richer in violet rays. An electric arc formed between carbon electrodes will be found to consist of a central portion of violet hue, which is doubtless the vapor of the carbon rendered incandescent at the crater. Surrounding this is a nonluminous portion where a dark flame indicates that the oxygen of the external air is being combined with the carbon and carbon monoxide produced. Outside of this is a luminous flame where the carbon monoxide is further oxidized and carbon dioxide formed. The character of the arc found between carbon

electrodes impregnated with certain metallic salts—the so-called “arc”—is quite different. In such arc flame itself is rendered intensely brilliant by the luminosity of these metallic vapors, due to the great heat of the arc, and only a very small portion of the light comes from the crater. Such arcs give from three to five times the illumination of an ordinary arc. The color of the light depends on the salts used, but is usually a warm orange yellow. A luminous arc lamp used extensively has an arc between a stationary copper electrode and a lower magnetite electrode. There are also certain substances which can be used as electrodes between which an arc can be established with but a comparatively slight elevation of temperature, but with an arc flame of great luminosity. In this class belong most vacuum arcs, such as the mercury arc, which is the source of light in the Cooper-Hewitt Mercury Lamp. The color of this light is a decided greenish blue, which largely offsets the advantages resulting from the high efficiency of the lamp.

For a description of the mechanical features of the various forms of arc lamps and the apparatus used in the various arc-lighting systems, see the articles on ELECTRIC LIGHTING, DYNAMO-ELECTRIC MACHINERY, and TRANSFORMER. The application of the arc in the production of high temperatures for FURNACES is discussed in the article on FURNACES. For a fuller description of the electric arc in reference to practical conditions in electric lighting, see Crocker, *Electric Lighting*, vol. ii (New York, 1901). A popular treatise on electricity, in which some attention is paid to the arc and its phenomena, is Thompson, *Elementary Lessons in Electricity and Magnetism* (New York, 1901). Consult also Ayton, *The Electric Arc* (8th ed., New York, 1908); *American Handbook for Electrical Engineers*, ed. by Pender (New York, 1914).

**ELECTRIC BELL.** See BELL.

**ELECTRIC BURGLAR ALARMS.** See ALARM.

**ELECTRIC CLOCK.** See CLOCK.

**ELECTRIC COLUMN.** See DRY PILE.

**ELECTRIC DISCHARGE.** See ELECTRICITY.

**ELECTRIC FISH.** A fish which possesses the power of discharging electricity at will. Electric organs are well developed in three sorts of fishes: (1) most strongly in the Brazilian electric eel; (2) in a genus (*Malapterurus*) of African catfishes; and (3), most weakly, in the torpedo family of rays. Electric organs are present, but developed to a much slighter degree, in some other fishes, which are spoken of as pseudoelectric. The organs are modified muscular tracts and nerve connections, by means of which the fish are able to give an electric shock. They lie, in the case of the torpedo, in the head and gill region; in the South American eel they are on the ventral surface of the long tail; and in *Malapterurus* they practically incase the entire body, or occur in lateral lines under the skin on each side of the tail. The electromotive force seems to be under the influence of the central nervous system, and the nerves supplying the organs are enormously developed. In the torpedo the “electric plates” are arranged vertically, and the current passes in the same direction from the lower to the upper side. In the other two they are arranged longitudinally, and the current in *Gymnotus* passes towards the head and in *Malapterurus* towards the tail. The

discharge, when the animal is at its best, may stun an animal as large as the horse. This power is of use, doubtless, in defense and probably in capturing smaller prey.

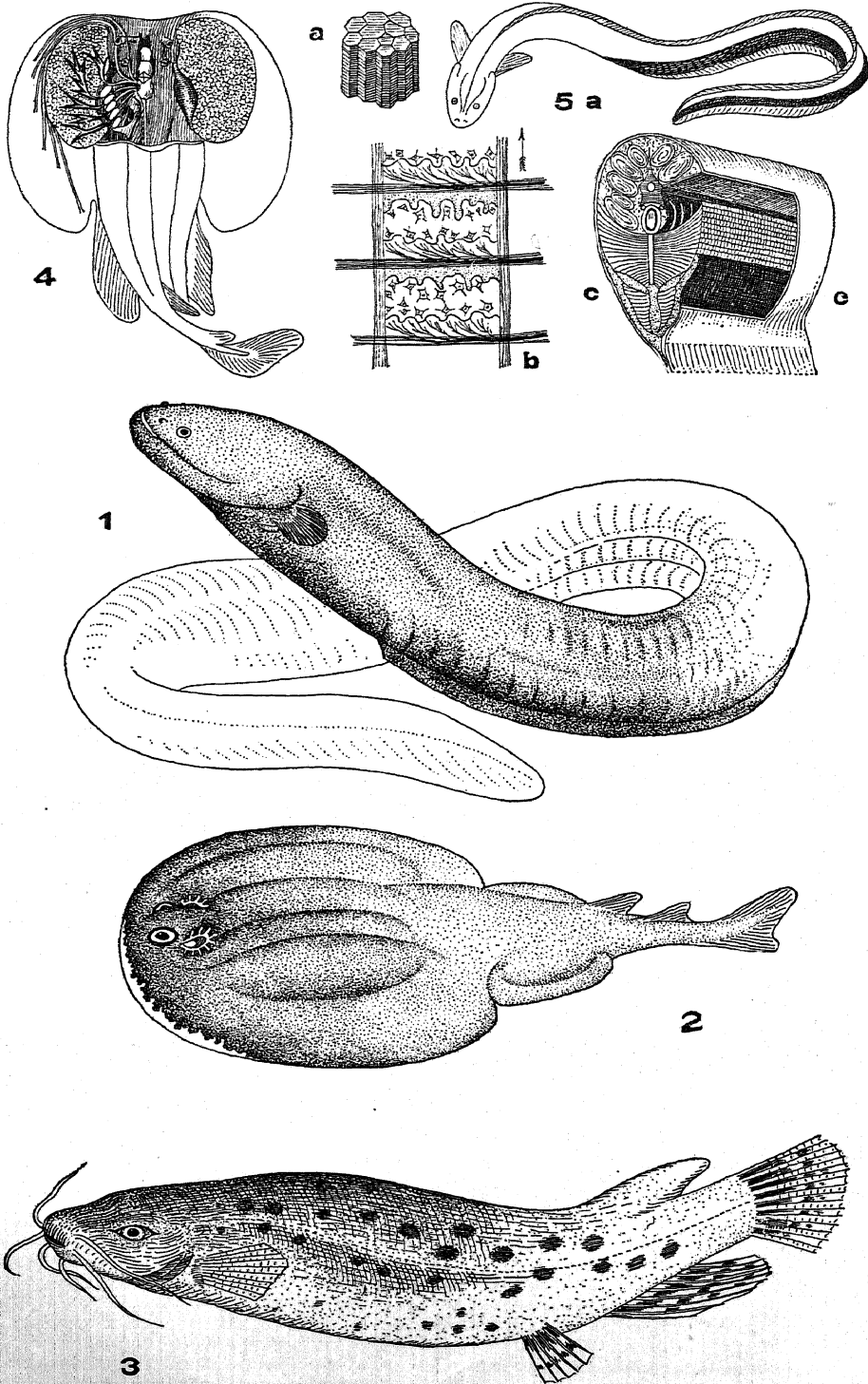
**Electric Eel.** This fish (*Gymnotus*, or *Electrophorus electricus*) inhabits the rivers of the basin of the Amazon and Orinoco, wherever they are warm and sluggish. It is in shape like a thick, stout, blackish, scaleless eel, and may grow to be 6 feet long; but it differs so much in structure from ordinary eels that it has been set apart as a separate family, Gymnotidæ, allied to the carps and catfish, or silurids. It is abundant and seems to have the general food and habits of an eel, but little is known in regard to its generation or the use of its battery, except that it habitually kills more fish than it can consume. The flesh is filled with bones, but is said to be palatable, and is not only eaten, but is regarded by the native South Americans as having medicinal value.

**Electric Catfish.** These shock-giving catfish compose the subfamily Malapterurinae, of which the best known is the raash (*Malapterurus electricus*) of the Nile. It lives in all the large rivers of the tropical part of Africa, is sluggish in movement, and lurks in dark places. Its flesh is used as food. It grows to a length of 4 feet, with the ordinary rayed dorsal fin replaced by a fatty dorsal fin just in front of the rounded tail. It is said to give a shock like that from a Leyden jar, which may be communicated by touching the creature with a conductor.

**The Torpedo.** The electric rays, or torpedoes, constitute a family closely allied to the true rays. They embrace about 6 genera and 15 species of the warmer seas of the world, and 2 species which approach the southern shores of the United States. They have rounded disklike bodies, with powerful tails, and may weigh 80 pounds; swim close to the bottom and are dark-colored above and light beneath, like other fishes of their class. The best-known species is *Torpedo marmoratus* of southern Europe, upon which Dr. Gunther, ichthyologist of the British Museum, made the following observations: He found that the phenomena attending the exercise of this extraordinary faculty closely resembled muscular action. The power is exhausted after some time, and it needs repose and nourishment to restore it. If the electric nerves are cut and divided from the brain, the cerebral action is interrupted, and no irritant to the body has any power to excite electric discharge; but if their ends be irritated, the discharge takes place, just as a muscle is excited to contraction under similar circumstances. And, singularly enough, the application of strychnine causes simultaneously a tetanic state of the muscles and a rapid succession of the involuntary electric discharges. The strength of the discharges depends entirely on the size, health, and energy of the fish. It seems to be “essential and necessary to them for overpowering, stunning, or killing the creatures [fish of various kinds] on which they feed, while incidentally they use it as the means of defending themselves from their enemies.”

**Anatomical Features.** The electric organs in all the above-named fishes are to be regarded, according to Wiedersheim, as metamorphosed muscular tracts, and the nerve endings belonging to them as homologues of the motor end plates which are ordinarily found on muscles. As regards the minute structure of the electric organs, the same essential arrangements are met with in

# ELECTRIC FISH



1. ELECTRIC EEL (*Gymnotus electricus*).
2. ELECTRIC RAY (*Torpedo marmorata*).
3. ELECTRIC CATFISH (*Malapterurus electricus*).
4. ELECTRIC ORGANS OF TORPEDO: a, polygonal rods.

5. ELECTRIC EEL (*Gymnotus*): a, situation of electric organ (black strip); b, structure of the same, enlarged; c, cross-section of eel's body, showing relative size and position of electric organ (e).



all the forms. The framework is formed of fibrous tissue, which gives rise to numerous polygonal or more or less rounded chambers (see Plate). Numerous vessels and nerves ramify in the connective tissue lying between these compartments, the nerves being inclosed in very thick sheaths and having a great variety of origin, according to the species. In the torpedo they arise from the "electric lobe" of the medulla oblongata, a single branch coming also from the trigeminal; in all pseudoelectric fishes, as well as in *Gymnotus*, in which over 200 nerves pass to the electric organ, they arise from the spinal cord. The electric nerves of *Malapterurus* arise on each side from a single enormous nerve cell, which, lying in the . . . of the second spinal nerve, is continued into a very large primitive fibre, which passes towards the end of the tail, dividing as it goes.

The end organs in which the nerves terminate are disks, called "electric plates" formed of muscle substance over one or the other side of which, according to the species, the terminal filaments of the nerve spread out. The side of the electric plate on which the nerve branches out is negative at the moment of discharge, while the opposite side is positive, and thus the different arrangements of the parts in *Gymnotus* and in *Malapterurus* render it clear that the electric shock must pass in different directions in these fishes—thus, in *Malapterurus* it passes from the head to the tail, but in the contrary direction in *Gymnotus*. In torpedo the discharge passes from below upward. The mechanism whereby the electric plates become temporarily charged with electricity is not known.

**Bibliography.** Although the peculiar powers of the torpedo and of the *Gymnotus* were well known to the ancients, the first scientific determination of the electrical character of the shock of the torpedo was by Walsh, in 1772, *Of the Electric Properties of the Torpedo* (Philadelphia, 1773). From that date the electric organs of fishes have been made the object of special study by some of the greatest anatomists and physiologists, among them Jobert de Lamballe, who published a special work entitled *Des appareils électriques des poissons électriques*. (Paris, 1858), accompanied by a magnificent volume of plates. More recent works are: Boll, *Ueber elektrische Fische* (Berlin, 1874); Sachs, *Untersuchungen am Zitteraal* (Leipzig, 1881); Fritsch, *Die elektrischen Fische* (ib., 1887, '90); Schönlein, *Beobachtungen und Untersuchungen über den Schlag vom Torpedo* (Munich, 1894); Gunther, *Study of Fishes* (London, 1880); Wiedersheim, *Comparative Anatomy of Vertebrates* (ib., 1897); Lydekker, Cunningham, Boulenger, and Thomson, *Reptiles, Amphibia, and Fishes* (ib., 1912).

**ELECTRIC FURNACE.** Strictly speaking an electric furnace is an apparatus for bringing about a physical or chemical change in materials by aid of heat obtained from the transformation of electric energy; the term, however, may be extended to include "electrolytic furnaces," in which the action is in part electrothermal, as in the electric furnace pure and simple, and for the rest electrolytic. This class of furnace is mainly employed for the electrolysis of fused salts, as, e.g., in the manufacture of aluminum, where a high heat is necessary to maintain the requisite fusion of the electrolyte.

The limit of heat practically obtainable with the use of ordinary refractory materials is very high, because in the electric furnace the fusing

material is at a higher temperature than the crucible, whereas in ordinary fusion the temperature of the crucible exceeds that of the material fused within it. The maximum temperature practically obtainable in nonelectric furnaces is about 2000° C., whereas a temperature as high as 3500° C. is easily reached and maintained in the commercial electric furnace.

Electric furnaces may be classified according to the method in which the heat is produced, as arc furnaces and resistance furnaces. The arc furnace consists essentially of an electric arc (see ELECTRIC ARC), usually with carbon electrodes inclosed in a chamber made of material which is both highly refractory and a poor conductor of heat, as, e.g., fire brick or chalk. In the resistance furnace the heat is produced by the passage of an electric current through some highly refractory material, as carbon, or some of the rare metallic oxides (such as those used in making the glowers for Nernst lamps), embedded in the wall of the furnace, or the heat may be developed directly in the material to be treated by using the latter as the conductor of the current. A very convenient form of resistance furnace is the so-called "induction furnace"; in this furnace the resistance element, either the furnace charge or some auxiliary material, instead of being connected directly with the circuit supplying the current, forms the secondary of a transformer (see TRANSFORMER); a small current at a comparatively high voltage in the primary of many turns induces the necessary large current at low voltage for heating the material to be treated, which forms a single turn secondary.

Electric furnaces are used chiefly in the manufacture of aluminum, calcium carbide, carborundum, graphite, phosphorus, special grades of iron and steel, and ferromanganese. (See ELECTRO-CHEMISTRY, INDUSTRIAL.) One of the simplest industrial applications of the resistance principle is found in the Acheson furnace used in the manufacture of carborundum. The furnace consists of a trough built up of loose bricks, with massive electrodes made up of a bundle of carbon rods projecting through the end walls. Between these electrodes lies a core of granular carbon, coke, or carbon rods. Around this core is packed a mixture of powdered coke, sand, and a small quantity of sawdust and common salt. The electrodes are then connected with the source of electric energy, and the proper current maintained flowing through the core to raise the temperature of the mixture of sand and coke to the point required for the combination of the silicon and carbon. In the furnaces used at Niagara this conversion takes about 36 hours. These furnaces are 15 × 7 × 7 feet. The electrodes consist of bundles of 60 3-inch carbon rods, each 2 feet long. The coke resistance core is 9 feet long by 2 feet in diameter. The power required to operate such a furnace is about 1000 horse power, or an energy consumption of approximately 4 kilowatt hours per pound of carborundum.

The most widely used types of arc furnace are those of Heroult, Stassano, and Girod. Each consists of a shallow refractory chamber mounted on a tilting rig. Through the roof of this chamber extend one or more large electrodes of carbon or graphite, from which an electric arc of great power is formed. The Heroult furnace is usually operated three-phase (see DYNAMO-ELECTRIC MACHINERY) and has three

electrodes between which a triple arc is formed above the surface of the molten charge. The Girod furnace is usually single-phase and employs a single carbon electrode, the molten charges serving as the lower electrode. The Heroult furnace is built in capacities up to 15 tons, the Girod furnace up to 12 tons, and the Stassano, now little used, up to 5 tons. All arc furnaces are subject to a marked disadvantage, viz., that the electrode material has a contaminating effect on the molten metal and renders difficult the refinement of steel to a precise quality.

The induction furnace consists of a ring-shaped hearth built of refractory brick and inclosed by a refractory cover which may be removed for charging purposes. This ring is linked by one or more upright transformer cores, built up of sheet-iron laminations. On these cores are wound coils of copper wire having a large number of turns, which are supplied with current from some high-tension alternating-current source. The metallic charge in the hearth forms a secondary circuit for these coils, and in it an enormous current of low voltage is induced by step-down transformer action. The flow of this current through the resistance of the metal mass causes it to give up its energy in the form of heat and raise the metal to a high temperature. The types of induction furnace in greatest use are the Kjellin and the Röchling-Rodenhauser. The former is a single-phase furnace, built in capacities up to 8.5 tons and supplied with alternating current of low frequency, usually from 5 to 15 cycles per second. The generation of single-phase currents of such low frequency requires special and expensive equipment. The Röchling-Rodenhauser furnace is of the three-phase type and is well adapted to standard commercial frequencies and generating apparatus. It is built in sizes up to 15 tons.

The accompanying table gives the approximate number of kilowatt hours of energy required for each ton of product with various initial charges:

Pig iron from ore, 2000 kw. hr.
Steel from ore, 3000 kw. hr.
Steel from cold pig iron, 1500 kw. hr.
Steel from fluid pig iron, 1000-1200 kw. hr.
Steel from cold pig and scrap, 900-1300 kw. hr.
Steel from fluid pig and scrap, 600-1000 kw. hr.
Steel from cold scrap, 600-900 kw. hr.
Refining low-carbon steel into special grades of steel, 120-300 kw. hr.

In general, the commercial use of electric furnaces is limited to those processes where a specially high temperature is required, or where the substances under treatment must be maintained in a pure state; and then only when electric power can be obtained at a comparatively low cost, as, e.g., in localities where there is an abundant supply of water power. Its greatest field is in the refining of common grades of iron and steel into special steels of greater uniformity than can be produced by the usual processes. Consult: Wright, *Electric Furnaces and their Industrial Applications* (New York, 1905); Moissan, *Le four électrique* (Paris, 1897); Stansfield, *Electric Furnace* (New York, 1914); Rodenhauser and Schoenawa, *Electric Furnaces in the Iron and Steel Industry* (ib., 1913); *American Handbook for Electrical Engineers*, ed. by Pender (New York, 1914).

**ELECTRIC FUZE.** See FUZE.

**ELECTRIC GENERATOR.** See DYNAMO-ELECTRIC MACHINERY.

**ELECTRIC HEATER.** Electric heaters con-

sist essentially of coils or circuits of some refractory metal through which the current is passed, these coils or circuits being surrounded by air or some insulating material, and the whole being placed in a metallic box or radiator, which throws off or radiates the heat produced. In the simplest form of electric heater exposed coils of wire or strips of metal are wound around insulating material or left surrounded by air. Another common form consists of wire or strips of metal embedded in asbestos, either in the form of coils or in flat layers. A third class of heater is made by embedding the resistance wire in some fireproof insulation, such as enamel or glass. The Tommasi heater consists of a coil of wire embedded in a material having great latent heat of fusion, such as crystallized acetate of sodium and hyposulphite of sodium. In these heaters the current is turned on until the desired temperature has been reached, and is then turned off and the latent heat allowed to dissipate itself. It is claimed that the heater remains active about four hours after the current is shut off. The Prometheus system consists of a broad strip of rare metal fused on to an enamel which forms the outside of the vessel, and the current is passed through the metal strip or film. In the recent forms of this heater the heating films of gold or platinum between mica sheets are used. In some cases an efficiency as high as 95 per cent can be obtained. The Le Roy system consists of inclosing sticks of crystallized carbon in glass tubes. In the Parville heater there are rods of metallic powder mixed with fusible clay, compressed under a pressure of 2000 kilograms per square centimeter and baked at a temperature of 1350° C. Unless electricity is produced at a very low cost, it is not commercially practicable for heating residences or large buildings. But the electric heater can be used advantageously in heating small offices, bathrooms, street-railway waiting rooms, for heating electric cars, etc. For heating laundry irons it is commonly figured that electrically heated and gas-heated irons are on a par in economy when gas costs one dollar per 1000 cubic feet and electricity costs one cent per kilowatt hour. The efficiency of electric cooking apparatus varies from 60 per cent to 90 per cent (for ovens), depending upon a number of variable conditions, such as time, size, quantity to be heated, and temperature rise. Of the total energy given off by burning a pound of coal in an ordinary cooking stove, only about 2 per cent is effective in the actual process of cooking, 12 per cent being wasted in obtaining a glowing fire, 70 per cent going in the chimney, and 16 per cent being radiated into the room. The efficiency of a gas stove is considerably greater, for some operations being as high as 20 per cent; but for ordinary cooking 15 per cent is a fair average. The most economical system for cooking or heating is not necessarily the one that has the highest efficiency; the cost of the particular form of energy must also be considered. In New York, in 1914, one dollar would buy 11 kilowatt hours of electric energy, 1333 cubic feet of gas, or 301 pounds of coal. Eleven kilowatt hours are equivalent to 9427 heat units; when burnt under suitable conditions, 1333 cubic feet of gas are capable of rendering 227,000 heat units; 301 pounds of coal burnt in an ordinary range will yield about 2,900,000 heat units. The



number of effective heat units in each case will be proportional to the efficiency of the respective types of stoves; for the electric oven at 85 per cent efficiency, 8012 heat units; for the gas stove at 15 per cent efficiency, 34,050 heat units; for the coal stove at 2 per cent efficiency, 58,000 heat units. For the same results electricity costs about seven times as much as coal and four times as much as gas. The advantages possessed by electric heaters as regards cleanliness and convenience, however, in many cases offset their lack of economy, and there are in use at present numerous devices, such as electric irons, broilers, chafing dishes, warming pads, and small radiators; in some places where electric power is cheap, even whole kitchen and laundry outfits have been installed. In a gas stove, considering the number of heat units obtainable at a certain price to be small compared with solid fuel, the ventilating current required for the operation alone consumes at least 80 per cent of the heat units obtained by burning the gas. In an electrical oven more than 90 per cent of the heat energy can be utilized; and thus, although 5 to 6 per cent only of the heat energy of the fuel is present in the electrical energy, 90 per cent of this, or  $4\frac{1}{2}$  per cent of the whole energy, goes into the food. Consult *American Handbook for Electrical Engineers*, ed. by Pender (New York, 1914). See WELDING; ELECTROCHEMISTRY, GENERAL.

**ELECTRIC HORN, IN MOTOR VEHICLE.**  
See MOTOR VEHICLE.

**ELECTRICITY.** Few sciences can claim as great an antiquity as that of electricity. It is believed that Thales of Miletus (c.640-546 B.C.) knew that amber, after being rubbed, acquired the property of attracting light bodies; and Theophrastus (c.372-287 B.C.), in his treatise *On Gems*, mentions the fact that this power is not peculiar to amber. No definite scientific information was acquired, however, until the close of the sixteenth century. William Gilbert (q.v.) published in 1600 his great work *De Magnete*. In this book he used for the first time the terms "electric force" and "electric attraction," and distinguished between "electrics" and "non-electrics"—the former name being given to bodies which act as amber does when rubbed; the latter to bodies, such as metals, which, when held in the hand and rubbed, do not acquire the power of attraction. He clearly distinguished between magnetic and electric action, as Cardan (1501-76) had also done before, but in an imperfect manner. Robert Boyle, Sir Isaac Newton, and others made many interesting observations on electrical phenomena, the former showing that electric attraction takes place through a vacuum. Otto von Guericke, the inventor of a rude form of electrical machine (q.v.), also discovered electric induction, the phenomena of which were studied with special care by Canton nearly a century later. Hawksbee made several important advances, being the first to show how to electrify metals by rubbing, and also the first to observe that electric charges are only on the surfaces of metals, not in the interior.

During the eighteenth century electric phenomena were studied very extensively, especially towards its close, when means of producing electric currents were discovered. Stephen Gray (q.v.), in the early part of the century, observed the important fact that electric forces could be carried for a considerable distance by means of

packthread and other bodies, thus discovering electric conduction, and he was then led to distinguish between conductors and nonconductors. The possibility of two kinds of electricity—vitreous and resinous, or positive and negative—was established independently by Du Fay in France and Kinnorsley in Philadelphia. The former developed also a two-fluid theory of electricity which persisted for many years. The Leyden jar was discovered by accident in 1745, and from this time on public exhibitions of electric phenomena were most popular. Most interesting and important work has been done also in America by Benjamin Franklin (q.v.) and a group of his friends. He proposed a one-fluid theory, which after more than a century of neglect has reappeared as a possible explanation of the new phenomena called "corpuscles" and ions. Having noticed the effect of points on conductors in discharging bodies and believing that lightning was an electric phenomenon, Franklin, in 1750, proposed an experiment to test his theory. It was to extend a long pointed wire upward from a steeple and to see if electrical charges could be observed at the lower end of the wire when a thundercloud passed overhead. The actual experiment was carried out in these directions in 1752, in France, by Lavoisier, and later by Delor, and in the same year Franklin performed his famous kite experiment. Soon after this lightning rods, which had been suggested by Franklin, became popular both in America and Europe. The main phenomena of pyroelectricity were discovered by Æpinus, Bergman, and Canton, about 1770. Many of the most important facts in electricity which were made known during the nineteenth century by Coulomb, Ohm, and Faraday were in reality discovered by Henry Cavendish (1731-1810), one of the world's greatest philosophers. He showed that the capacity of a condenser varied with its size and with the nonconductor used; he studied the conducting power of solutions; and he also discovered what is now called Ohm's law. He saw, further, from mathematical considerations, that if electrical charges act on each other with a force varying directly as the amounts of the charges and inversely as the square of their distance apart, then a charged conductor must have its charge entirely on its surface; whereas, if the law of action were different, there would be some charge on the interior. By a most ingenious experiment, performed before 1773, he showed that, to the limit of accuracy of his apparatus, there was absolutely no charge on the interior. These electrical papers of Cavendish were not published until 1879, when they were edited by Clerk-Maxwell. The law of electric action was proved independently and in a less accurate manner by Coulomb (q.v.) in 1785.

Many improvements in electrical apparatus were made; a circular glass plate and a rubber cushion coated with a tin amalgam were substituted for the sulphur globe and the hand as used by Von Guericke. The gold-leaf electroscope was invented in 1786 by Abraham Bennet and was improved by Volta (q.v.). The latter also, in 1775, invented the electrophorus.

In 1780 Galvani (q.v.) made the historic observation in regard to the twitching of the frog's legs, which was followed by the discovery in 1794, by Volta, of the correct explanation. This led at once to the invention of the so-called voltaic pile and voltaic cell, a description of

which was communicated by Volta in a letter to Sir Joseph Banks, written March 20, 1800. Means were thus furnished for maintaining electric currents. Within a few weeks after Volta's letter Nicholson and Carlisle in England constructed a pile and by means of it observed and studied the decomposition of water.

The progress of the science of electricity during the nineteenth century was so rapid that it is impossible to do more than to note the most important steps. The investigation of the action of an electric current when passed through liquids was continued by Sir Humphry Davy (q.v.) and Michael Faraday (q.v.), to the latter of whom is due the statement of the laws of electrolysis. The theoretical explanation of the phenomena is the work of Grothuss, Faraday, Hittorf, Clausius, and Arrhenius. Improved cells for the production of currents were made by Sturgeon, Daniell, Grove, Bunsen, and others. So-called "storage" cells, or secondary cells, were first described by Ritter in 1803 and were improved by Planté and by Faure.

In 1819 Oersted discovered the magnetic action of an electric current, and the exact mathematical laws stating the action of a current upon a magnet and of one current upon another were deduced by Biot and Savart (1820) and by Ampère (1821).

And Davy (1820) discovered independently that a current passed through a helical conductor magnetized a steel needle placed inside. Sturgeon, in 1825, made the first electromagnet, using a single helix of wire wound round a bar of iron shaped like a horseshoe, varnish being used to insulate the coils of the wire. Joseph Henry (q.v.) showed how this magnetic action of a current could be increased. He insulated the wire by means of silk cloth and wound it in layers like thread on a spool. By means of an electromagnet made on this principle Henry constructed a telegraph instrument.

The galvanometer was invented by Schweigger in 1820 and the astatic needle by Nobili in 1825; but the modern forms of the instrument are due to the genius of Lord Kelvin. The phenomena of thermoelectricity were discovered by Seebeck in 1821; the Peltier effect, in 1834.

The discovery of induced currents was made independently by Henry and Faraday in the years 1829-31; and the latter described the principle of the dynamo which has been perfected in recent years by Wilde, Siemens, Gramme, and countless others. The first induction coil was made by Charles Page, of Washington, D. C., in 1838. In 1842 Henry proved that the discharge of a Leyden jar was oscillatory—in which he had been anticipated by Savary (1827)—and discovered the existence of waves in the ether produced by such a discharge. The mathematical theory of the discharge was given by both Kelvin and Helmholtz, and that of the waves by Clerk-Maxwell. The properties of the waves were investigated by Hertz in 1888, and more recently by Marconi and others, who have made commercial use of them.

To Faraday is due the realization of the importance of the properties of the nonconducting media separating charged bodies. He proved that both electrostatic and magnetic actions take place *through* the media, not "at a distance." He originated the idea of lines of induction and established their laws; he also explained the attraction and repulsion of bodies caused by electrical or magnetic forces as due to the

relative properties of these bodies and of the surrounding medium. Clerk-Maxwell expressed Faraday's experimental discoveries in mathematical language and formulæ and advanced the theory of electricity and magnetism which is the basis of all modern theories.

The idea of expressing all electrical and magnetic quantities in absolute units, based on some definite system of standards of length, time, and mass, is due to Gauss (q.v.) and Weber (q.v.).

The most important recent advances in the knowledge of the connection between electricity and matter have come through the observation of the ionization (q.v.) of gases. Most of the researches along this line have been made under the direction of Prof. J. J. Thomson, at the Cavendish Laboratory, Cambridge, England.

To understand the fundamental principles of electricity, it is well to start with the experiments that were performed by the early Greeks.

Here it is found that, if two bodies are brought into intimate contact, e.g., by pressure or by rubbing together, and then separated, they have certain new properties, the most marked of which is the power of attracting any small bits of matter, such as particles of dust or fragments of paper. This power is said to be "electricity." It is found that, if certain bodies, such as glass, rubber, silk, are charged, the electrical effects are manifested only at the points where the contact was made with the other body; while with other bodies, such as pieces of metal, the electrical effects are manifested over the whole body regardless of where the contact was made, and the charge is said to spread over the surface. Bodies of the latter kind are called "conductors"; of the former, "nonconductors." It takes time—infinitesimally short—for a charge to distribute itself over the surface of a conductor; but in the end, unless there is further charging, conditions come into a steady state; the charges are said to be at rest. The science of the distribution and other properties of electrical charges at rest is called "electrostatics," while the study of the phenomena involved in varying and moving charges belongs to "electric currents," or "electrokinetics."

## ELECTROSTATICS

**Fundamental Phenomena.** As said before, the primary fact of electricity is that, when two bodies are brought in contact and then separated, they acquire the power of attracting small portions of matter. Further, the two bodies which are thus charged attract each other, as may be shown by suspending one so that it is free to move and bringing the other near it. If other portions of matter are charged, e.g., pieces of rubber, of dry wood, of cotton cloth, of paper, of fur, it will be observed that, when they are brought near a suspended glass rod which has been charged, there are some cases of attraction and others of repulsion. All charged bodies which attract a piece of glass charged by contact with silk are said to be "negatively" charged; and all charged bodies which repel the charged glass are said to be "positively" charged. It is found by experiment that any positively charged body will repel any other body positively charged; any negatively charged body will repel any other negatively charged body; any

negatively charged body will attract any positively charged body.

It is found that glass rubbed with silk is positively charged, but if rubbed with cat's fur it is negatively charged. It is possible to make a tabular arrangement of bodies in which any body when charged by contact with any other body lower down in the series becomes positively charged, the second body becoming negative. Such a table is called the "electrostatic series"; a few of its members are the following: cat's fur, glass, paper, flannel, silk, cork, metals, ebonite, sealing wax, sulphur, hard rubber.

As noted above, natural bodies may be divided into conductors and nonconductors; conductors being such bodies as allow charges to spread over them, while nonconductors keep the charges localized where the contact took place—a "charge" meaning simply a condition at the surface of a body such that there are forces of attraction or repulsion manifested there on other charged bodies or on light pieces of matter. Among the conductors are: all metals, water containing some salt or acid in solution, damp thread, the human body, the earth. Glass, sulphur, paraffin, dry wood, silk, paper are nonconductors or insulators. Thus, if a piece of metal is held in the hand when it is charged, the charge will distribute itself over the metal, the hand, and body, and sometimes over the floor if it is not dry; and therefore the charge left on the metal itself may be extremely small. It is necessary, then, in order to charge the metal strongly, to hold it in a piece of paper or other nonconductor. Charges may be transferred from a charged body to an uncharged one simply by allowing their surfaces to touch. If a charge is given a conductor and allowed to come to rest, it is found to be entirely on the surface, not in the interior. Thus, there are absolutely no electrical forces *inside* a hollow, closed conductor which is charged, unless a separate charge on a different body is placed inside.

If a charged body is brought near an uncharged one which is separated from the earth by a nonconductor, i.e., is "insulated," electrical forces may be observed near the latter of the two bodies; it is said to be charged by "induction." If the body which was originally charged was positive, the portion of the other body which is nearest it is now negatively charged, and the portion which is farther away is positively charged. Exactly the reverse is true if the body which was originally charged is negative. If the charged body is now removed to a distance, the "induced charges" will disappear. If the body which was originally uncharged is joined to the earth by a conductor, and if, after the charged body is brought near, this conductor is removed, the former body will be found to be charged; and this charge will now remain even when the originally charged body is removed. To join a conducting body, e.g., a metal sphere, to the earth by a conductor is most simple; it is necessary to join it by a wire to a gas or water pipe: but to connect a nonconducting body, e.g., a glass sphere, to the earth is not at first sight so easy; it can be done, however, by holding a Bunsen burner so that the flame spreads over the whole surface of the body, because the gases in the flame are good conductors. In both cases it is evident that the action of the connecting conductor is to make the earth itself a portion of the originally uncharged body, and so the induced

charges are distributed, one on the earth and one on the body itself. This last is of a kind opposite to that of the body which originally was charged, and it remains after the connection with the earth is removed.

There are thus three methods of charging a body: (1) by contact with another body and then separation; (2) by contact with another charged body; (3) by induction as just described. The fact that, when a charged body is brought near an uncharged one, there are charges induced on the latter, of such a kind that an unlike charge is nearest the former, accounts for the observed attraction of small particles of matter by charged bodies. It should be noted particularly, however, that the forces of attraction or repulsion between charged bodies vary greatly with the nature of the surrounding medium, being greater in air than they would be in pure water; and the character of the induced charges and the question of attraction or repulsion depend upon the *relative* properties of the surrounding medium and the body on which the induced charges are. The importance of the consideration of the surrounding medium was first emphasized by Faraday, who gave the name "dielectric" to the material medium around charged bodies, because the electrical actions evidently take place through it. All nonconductors can serve as dielectrics, and so can certain poor conductors under certain conditions. It will be shown later that the potential energy of charged bodies depends directly upon certain properties of the dielectrics in the neighborhood; and whenever any motions of attraction or repulsion take place, they are always such that by the change the potential energy is decreased.

A special case of induction which is of great theoretical and practical importance is one due to Faraday and called the "ice-pail experiment," because first performed with a metal ice pail. If a positively charged body, suspended by an insulating cord, is lowered carefully into a nearly closed hollow conducting vessel which is insulated from the earth, in such a manner as not to touch the vessel, positive charges may be observed on the outside of the latter. These charges do not change in any way, however the charged body inside is moved about. If this body is removed without having touched the vessel, the charges on the latter disappear. Similarly, if a negatively charged body had been lowered into the vessel, negative charges would have appeared on the outside. Now, if a charged body, together with the other body with which it was originally in contact and so electrified, is lowered into the vessel, there is no effect on the outside of the latter; the action of one charge neutralizes that of the other; they are said to be of "equal quantity," but of opposite sign. Thus whenever a positive charge is produced, an equal negative charge appears also. In the first experiment, therefore, with the hollow conducting vessel, when a positive charge appears on its outer surface, there must be an equal negative charge on its inner surface, which is nearer the positively charged body lowered in from above. If this last body is a conductor, and if it is allowed to touch the hollow conducting vessel, thus forming part of the conductor, two things may be observed: (1) there are no longer any charges inside, everything is discharged; (2) the charges on the outer surface have not changed at all, either in intensity

or position. This experiment proves, therefore, that the positive charge lowered into the vessel induces an equal negative charge on the inside of the vessel and an equal positive charge on the outside. The series of experiments shows, further, that the region outside a closed conductor is unaffected by any production or motion of charges inside. It has been stated before that a charged conductor has all the charge on its outer surface unless a charge is separately introduced inside; so, if charges are moved outside a hollow closed conductor, there will be no electrical forces inside. Therefore a closed conductor separates space into two quite distinct portions.

**Law of Electrostatic Action.** In order to give a numerical value to an electric charge various steps are necessary: 1. Two charges are defined to be equal if they produce the same effect of attraction or repulsion on any third body; in particular, if the two together produce no action, one is equal and opposite to the other. 2. A unit charge is defined to be such that, if two particles of matter have each a unit charge and are at a distance of one centimeter apart in a vacuum, the force between them is one dyne. 3. If two or three or four, etc., unit charges are given a body (e.g., by lowering them into a hollow closed conductor), it will exert a force two or three or four, etc., times that which it would if it had a unit charge. To give a numerical value, therefore, to any charge, it is necessary to find that combination of unit charges or multiples or fractions—which has the same action on any third body as does the charge for which a number is desired. The number of these unit charges gives the numerical value sought. If, now, two particles of matter are electrically charged, one with a quantity  $e$ , the other with a quantity  $e'$ , and if they are at a distance apart of  $r$  centimeters, the mechanical force of attraction or repulsion is found by experiment to satisfy the law that "the force varies as the product  $ee'$  and inversely as  $r^2$ ." In symbols, the force

$$f = \frac{ee'}{Kr^2},$$

where  $K$  is simply a factor of proportionality and is a different constant for different dielectrics. In particular, by the definition of a unit charge, if  $e = e' = 1$  and  $r = 1$ ,  $f$  must equal one dyne if the medium is the pure ether; and therefore on this system of units  $K = 1$  for the ether of space free from matter. This system, based on the above definition of a unit charge, is called the "C. G. S. electrostatic" system. (The "dimensions" (q.v.) of an electrical charge may be found at once from the above formula.  $e$  and  $e'$  are both charge; and hence a charge has the same dimensions as the square root of  $Kr^2f$ . Force has the dimensions  $MLT^{-2}$ ; therefore the dimensions of a charge are  $(KML^3T^{-2})^{\frac{1}{2}}$ , or  $M^{\frac{1}{2}}L^{\frac{3}{2}}T^{-1}K^{\frac{1}{2}}$ . Until something is known of the nature of  $K$ , there can be no mechanical understanding of an electrical charge.) That portion of this law of electrostatic action which says that the force varies as  $ee'$  and inversely as  $r^2$  is known as "Coulomb's law." It has been tested experimentally in two ways: one directly, by placing charges at different distances; the other indirectly, for it can be proved mathematically that only if this law is true will there be no electrical force inside a closed hollow con-

ductor, e.g., a spherical shell. Coulomb (1785) applied the first method, which is not accurate; and the second was used by Cavendish (1773) and later by Clerk-Maxwell. The fact that the force depends upon the medium was discovered by Cavendish (about 1772), and later independently by Faraday who thoroughly investigated the subject.

**Electric Potential.** In the case of any charged body forces are brought near or moved about; it is said to be surrounded by a "field of force." The "direction" of the field at any point is defined as that in which a particle of matter positively charged would move if placed at that point and left free to move. If a line is drawn such that at each of its points its direction gives that of the field, it is called a "line of electric force." Such a line evidently starts from a positive charge and ends on a negative one; there is therefore no line inside a closed conductor owing to its charge. Further, these lines are perpendicular to the surface of a charged conductor; for, if they were not, there would be a component of the force in the surface itself and consequently there would be motion of the charges, because a conductor is such a body that there is no opposition to a force tending to move a charge; and this would be contrary to the assumption that the charges are at rest.

The work required to bring a particle with a unit positive charge from the surface of the earth to any point in the field of force round a charged body is called the "electric potential" at that point. (The earth is taken as the starting point because it is a huge conductor whose electric condition may be assumed to be steady; and this definition of potential is equivalent to defining the potential of the earth as being 0. Potentials are measured with reference to that of the earth, just as temperatures on the centigrade scale are measured with reference to that of melting ice.) If one point has a higher potential than another, it requires work to carry a unit positive charge from the latter point to the former; and hence a force must have been overcome; in other words, lines of force always pass from points of high to points of lower potential. It is evident, further, that the potentials of all points of a charged conductor and of all points inside are the same. Therefore the motion of a positive charge is always from high to low potentials, and that of a negative charge is in the opposite direction.

If a positive charge is separated from a negative one by some medium such as air, glass, or paper, and if the charges are large, the difference of potential between any two points of the field which are close together will also be large, and there will be a strong force tending to move positive and negative charges in opposite directions. This force may become so great that there is a rupture of the material medium, air, glass, or paper, and a "spark" is seen. The principal action in the spark is to make the medium conducting; and so the positively and negatively charged bodies are joined by a conductor and totally or in part discharged. There are other effects of the spark, notably the thermal and luminous ones. Two conductors of similar shape, separated from each other by a thin layer of dielectric, form what is called an "electric condenser"; because, if one is charged positively and the other with

an equal quantity of negative electricity, the potential of the former is lower than it would be if the latter conductor were absent, and therefore it can be charged with a greater quantity, with less danger of sparks passing off to the earth and thus discharging it.

Common forms of condensers (see CONDENSER) are parallel plates of tin foil separated by glass or paraffined paper, coaxial cylinders, etc. One of the most familiar types is the "Leyden jar," which consists of a glass bottle coated inside and out, except near the opening, with tin foil.

It is observed that, if a conductor is charged which has sharp points, the charge rapidly disappears. This is owing to the fact that the fall of potential from the conductor into the air is most rapid at the points, and thus minute sparks pass off to the air, giving charges to the particles in the air which are then repelled. Similarly, if a charged body is brought near an uncharged insulated conductor which has sharp points turned towards the charged body, the latter induces charges on the conductor. Those on the side near the charged body pass off the points, are carried across, and discharge the former, leaving a charge on the conductor of the same kind as that on the body which was originally charged.

**Capacity.** If the charge on an isolated conductor is increased, so is its potential, because more work would be required to bring up a unit charge; if the charge is doubled, so is the potential. In other words, the charge equals a constant times the potential. If  $e$  is the charge and  $V$  the potential,  $e = CV$ . This constant  $C$  depends naturally on the shape and size of the conductor and on the surrounding dielectric; it is called the "capacity" of the conductor. Similarly, if a condenser is charged with  $+e$  and  $-e$ , and if the potentials of the two conductors are  $V_1$  and  $V_2$ , there will be a constant relation between  $e$  and  $V_1 - V_2$ , which may be expressed  $e = C(V_1 - V_2)$ . This constant  $C$  depends upon the shape, size, and distance apart of the two conductors and on the nature of the dielectric which separates them; it is called the "capacity of the condenser." It was first observed by Cavendish and later by Faraday that the capacity of a condenser was different for different dielectrics, e.g., air, glass, etc. Thus, if the same charge is given two condensers which are identical except in that one has air for its dielectric and the other glass, it is observed that the difference of potential is greater in the former than in the latter, thus showing that the capacity of the latter is the greater. The ratio of the two capacities was called by Faraday the "specific inductive capacity" of the glass with reference to air. If, instead of using air as the dielectric, there had been a vacuum, the ratio of the capacity of the glass condenser to the vacuum one would be a constant which is characteristic of glass and is called its "dielectric constant." It can be shown easily that this constant is the  $K$  which occurs in the formula for electric action.  $K$  is said to measure the "inductivity" of the dielectric.

It may be proved from mathematical reasoning that the capacity of an isolated sphere of radius  $R$  in a medium whose dielectric constant is  $K$  is  $4\pi KR^2$ ; the capacity of a condenser of two parallel plates of area  $A$  and at a distance apart  $d$  with a dielectric of constant  $K$  is  $KA/4\pi d$ ; etc.

**Energy.** Since, when a body is brought by bringing it in intimate contact with another body, e.g., glass with silk, and then separating them, one is charged positively and the other negatively, it requires work to pull them apart. The electrical separation therefore has an amount of energy equal to this work. This energy is present as a *strain* in the ether and dielectric which surround the charged bodies, as is shown by the fact that, if the charges are too great, the dielectric is ruptured—a spark passes. Since charges are always on the surfaces of conductors, it is evident that the material of a conductor yields to whatever stresses accompany charges and so cannot be under a strain. Faraday has shown that the strain in the dielectric is of the nature of a tension along the lines of force and a pressure at right angles to them. If a condenser has a charge  $+e$  and  $-e$ , and a difference of potential  $V_1 - V_2$  between the conductors, the process of charging may be imagined as having begun when there was no charge (and therefore no difference of potential), and that minute quantities of positive charges were carried from one plate to the other, leaving therefore equal amounts of negative on the first plate. In this way the charges will gradually grow to  $+e$  and  $-e$ , and the difference of potential will increase at the same rate from 0 to  $V_1 - V_2$ , the average difference being therefore  $\frac{1}{2}(V_1 - V_2)$ . The difference of potential between the conductors at any instant is by definition the amount of work required to carry a unit positive charge from one plate to the other; therefore, since in the process of charging the condenser a quantity of positive charge  $e$  has been carried across at the average difference of potential  $\frac{1}{2}(V_1 - V_2)$ , the work required is  $e$  times  $\frac{1}{2}(V_1 - V_2)$ . In other words, the energy of the charged condenser is  $W = \frac{1}{2}e(V_1 - V_2)$ . Expressed in terms of the capacity,  $C = \frac{e}{V_1 - V_2}$ , this becomes  $W = \frac{1}{2}e^2/C$ .

It has been shown that  $C$  varies directly as  $K$ , the dielectric constant, which is greater for glass or paper than for air; therefore, if in an air condenser the air could be replaced by glass or paper, keeping the charges unchanged, the energy would be diminished. It follows then that, since changes take place in nature in such a way as to decrease the potential energy, the paper or glass would be "attracted" in between the charged conductors. All cases of electric attraction and repulsion may be explained in a similar manner.

**Electric Oscillations.** If an isolated conductor is charged, there will be a definite distribution of charge over the surface in such a manner as to satisfy the law of electric action; but if another conductor is brought near it, the distribution will be altered by the new forces due to induction. If now this second conductor is suddenly removed, or if the forces of induction are suddenly destroyed, the charge will return to its original distribution. Before doing so, however, there will be what may be called "electric oscillations"; i.e., if the  $+$  charge has been drawn towards one end of the conductor by the forces of induction, then, when these are removed, it will appear at the farther end, next return towards the first end, etc., gradually coming to its state of equilibrium. These oscillations are extremely rapid and generally die

away very quickly. The simplest mode of producing electric oscillations is to bring close together two conductors and charge them oppositely until a spark passes; this has the effect of joining them with an extremely good conductor. It may be shown that, as a result, the conductor which was charged positively becomes negatively charged, then positively, etc., each successive charge becoming less and less, until finally equilibrium is reached. This is what happens in general when the two conductors forming a charged condenser, e.g., the two coatings of a Leyden jar, are brought so close together that a spark passes. (The analogy to a vibrating pendulum slowly coming to rest is complete.) As a result of this oscillatory discharge, the energy of the charges disappears, it being spent, in part, in producing disturbances in the surrounding dielectric of the nature of waves. These waves are in the ether and have identical properties with those which affect the sense of sight or temperature, being, however, longer, i.e., of a smaller wave number. They do not appeal to any human senses, but may be detected by various physical means. See WIRELESS TELEGRAPHY; COHERER.

**Electrical Instruments.** Electric charges may be produced by various machines which render the processes of charging by contact or by induction continuous and automatic. The commonest forms are the frictional machine (see ELECTRICAL MACHINE) and the electrophorus (q.v.), the induction machine.

Instruments have been devised to measure difference of electric potential both absolutely and relatively. They are called electrometers and are described under that title elsewhere. See ELECTROMETER.

**Faraday Tubes.** A convenient mode of describing electrical phenomena is due to Faraday, who pictured the electric field around charged bodies as filled with tubes whose sides were made by lines of force. These tubes join positive with negative charges and are chosen of such a cross section that, where they meet a charged surface, the open end of each tube incloses a unit charge. The tube will have in general a varying cross section, depending on the paths of the lines of force, and where the electric force is the greatest the tubes are most numerous.

#### ELECTROKINETICS

**Fundamental Phenomena.** If a charged electrical condenser is discharged by joining its two conductors or "plates" by a long conducting wire, it is observed that there is no oscillation, but that the charges disappear and there are certain phenomena in and near the wire. The temperature of the wire is raised; and a magnet suspended, free to turn, near the wire and parallel to it, will be deflected so as to tend to stand at right angles to it. In special cases other phenomena may be observed. The whole phenomenon is described by saying that an "electric current" has passed through the wire, in the direction from high potential to low, carrying the quantity of electricity  $e$ , where  $+e$  and  $-e$  were the charges on the condenser. In this statement there are three definitions: that of "electric current," "direction of the current," and the "quantity carried by the current." The two effects of the current noted are: (1) heating effect in the conductor; (2) magnetic action on a suspended magnet. These actions are

observed with all electric currents; and other additional effects are obtained when the current is not steady. It should be noted, further, that, if the direction of the current in the wire is reversed, the heating effect is as before, but the magnet is deflected in the opposite direction. This furnishes an easy method of determining the direction of the current in the conductor. If charges can be supplied to the terminals of the long conducting wire as fast as they disappear—as can be done by using an electric machine or other means—the condition in the wire and around it is said to be that of a "steady" or "uniform" electric current. In other words, to maintain a steady current in a wire, its terminals must be kept at a constant difference of potential; and the quantity of positive electricity supplied to one end or of negative supplied to the other in each second of time is called the "intensity" of the current, or the "current strength." The quantity of electricity carried by the current is evidently the product of the current strength and the time. The difference of potential between two points on the wire is called the "electromotive force" (E. M. F.) between those points. It evidently requires energy to maintain a uniform current, because of the energy spent in thermal actions.

**Sources of Electric Currents.** To maintain a steady electric current, some method must be used which will produce a constant difference of potential. Four may be mentioned: 1. If an ordinary electrostatic machine is used, it will be found to give a current of small intensity, the energy for the current coming from the work done in producing the charges by means of the machine. 2. If two wires of different material, e.g., brass and iron, are joined end to end, forming a single circuit, there will be two junctions of brass with iron; and if these two junctions are kept at different temperatures, there will be (in general) an electric current round the circuit. The energy for this current comes almost entirely from the source of heat at the hot junction, but it may come in part from the fall of temperature of one of the wires. The E. M. F. of the current is, as a rule, extremely small. (See THERMOELECTRICITY.) 3. If two different solid metals, e.g., rods of copper and zinc, dip into a dilute solution of sulphuric acid in water, the two metals will be found to be at a difference of potential. The same is true of any two metals dipping into any liquid—other than a fused metal—which is an electric conductor. Such an arrangement is called a "cell," or "element." The one mentioned has many disadvantages, some of which may be obviated by using two liquids separated by a porous partition. (For a description of different types of cells, see VOLTAIC CELL OR BATTERY.) If a cell, as described above, consisting of a zinc and a copper rod dipping in dilute sulphuric acid is used to produce a current in a wire joining the projecting ends of the two rods, it is observed that the current in the wire is in the direction from copper to zinc; that the zinc rod wastes away, and the loss in mass of the zinc is proportional to the current strength and to the time; that bubbles of hydrogen gas form at the copper rod. It is known from chemical experiments that, when zinc is dissolved in a vessel containing dilute sulphuric acid, hydrogen gas is formed, and the temperature rises, showing that in the reaction energy is given out. In the simple cell just described the zinc dissolves, hydrogen gas is



formed, and the energy liberated is used in producing the electric current. A similar explanation of the supply of energy may be given for all cells, it being noted, however, that in some cases energy is taken from the liquid of the cell itself—apart from chemical action—as is shown by its fall in temperature, and in others energy is given to the cell, as is shown by a rise in temperature. 4. Electric currents may be produced by dynamos (see DYNAMO-ELECTRIC MACHINERY), the principle of which will be examined under *Induced Electric Currents*.

**Heating Effect of Currents.** Since in a current through a conductor a certain quantity of electricity is passed from high to low potential, it is losing energy, which in turn is gained by the conductor. Thus, if a quantity  $e$  has its potential lowered by  $V_1 - V_2$ , the loss of energy is  $e(V_1 - V_2)$ ; and this is the energy gained by the conductor. If  $i$  is the current strength, and  $t$  is the time taken for a quantity  $e$  to pass,  $e = it$ .  $V_1 - V_2$  is the electromotive force and may be written  $E$ . Hence the energy gained by the conductor is  $Eit$ . This goes into heating effects and is manifest by a rise in temperature. Illustrations of this heating effect of a current are furnished by the glow, or incandescent, lamp, by the arc lamp, by electric furnaces, etc. One form of lamp (see ELECTRIC LIGHTING) consists of a thin loop of compressed carbon or tungsten inclosed in a glass bulb from which as much air as possible has been exhausted, the two ends of the filament being joined to two fine wires of platinum which enter the exhausted space from without. If by means of these platinum wires an electric current is made to pass through the filament, the latter will be raised to incandescence by the heating effect of the current; but it will not burn, because there is no oxygen in the bulb for it to combine with. The reason for the heating effect being so great in the filament is that it offers a great opposition to the passage of the current, and so a great amount of energy is necessary to force the current through.

The arc lamp consists of two carbon rods so kept by automatic devices that there is a small gap between them. When the lamp is started, the rods are in contact, and a current is forced through from one rod to the other; there is a great rise in temperature at the point of contact, owing to the great resistance to the passage of the current—this makes the air a good conductor; then the poles are drawn a slight distance apart automatically; and owing to the resistance to the current passing from the carbon to the air, the carbon tips are heated white-hot and emit light. See ELECTRIC LIGHTING.

**Magnetic Action of a Current.** If a long, straight wire carrying a current is held over and parallel to a pivoted magnetic needle, the needle will be deflected to one side or the other, depending upon the direction of the current. The simplest statement of the law of the magnetic action of a current is that a wire carrying a current is surrounded by rings of magnetic lines of force, the connection being such that, if a right-handed screw be imagined placed so as to coincide with the conductor, and if it is turned in the manner indicated by the line of magnetic force, its motion of translation will be in the direction of the current.

If the conductor is bent in the form of a loop, lines of magnetic force will enter the loop on one side and return outside the loop, each line

forming a closed curve. Thus, the face of the loop which the lines enter is like the south pole of a magnet, and the opposite face is like the north pole. In other words, the magnetic action of the loop of wire carrying a current is like a thin sheet of iron filling the area of the loop and so magnetized that all the north poles are on one face and the south poles on the other.

Similarly, if the wire is wound in the form of a helix or spiral spring, the lines of magnetic force will enter at one end of the helix, pass along its length, and, emerging from the opening at the farther end, return outside, forming closed curves. A helix like this when it carries a current has, therefore, the properties of a bar magnet. If a small magnet is placed inside this helix, it will turn and place itself along the line of magnetic force; similarly, if a rod of soft iron or other magnetic substance is wound with an insulated wire helix carrying a current, it will be magnetized. Such magnets are called "electromagnets" and in various forms they play an essential part in call bells, telegraph and telephone instruments, dynamos, motors, etc. The bar of iron is generally so bent that its two ends face each other; sometimes it forms a "horseshoe." One of its ends is then a north magnetic pole, and the other a south pole whenever the electric current is passed through the enveloping helix of wire. Since conductors carrying currents have the magnetic properties of magnets, they have forces of attraction and repulsion on each other and on magnets. It may be shown that all these various cases of force may be embraced in the statement that "motions take place in such a manner that the circuits of conductors inclose the greatest possible number of lines of magnetic force emerging from the north faces of the circuits, or the least number of lines emerging from the south faces." The action of electric motors is based on this principle. See DYNAMO-ELECTRIC MACHINERY.

Many instruments for the detection or measurement of electric currents are based upon their magnetic action. If a magnet is pivoted so as to be free to turn around a vertical axis, and if it is placed in the plane of a loop of wire, it will be deflected if a current is passed through the loop, thus making a "galvanoscope." (See GALVANOMETER.) The delicacy of the instrument may be increased in many ways: making the magnet light and short, winding the wire in several turns instead of a single loop, suspending the magnet by a fine fibre with little if any torsional resistance, making the magnet "astatic."

An astatic magnet is really a combination of two (or more) magnets rigidly fastened to a stiff rod or staff, and so placed that the directive magnetic action of the earth is destroyed as far as possible. This is done by placing the magnets in opposite directions, but in the same plane, and making them as nearly as possible of the same strength. In suspending this compound system in the galvanoscope it is so arranged that one magnet (or set of similar magnets) comes inside the coil of wire, while the other magnet (or set of magnets), turned in the opposite direction, lies outside the coil.

In another type of instrument a flat coil of wire is suspended by a wire which has torsional rigidity between the two poles of a horseshoe magnet, so that the line joining the poles is par-



into parts, i.e., "ionized"; although the ions in a gas are by no means the same as in a liquid electrolyte. Some of the methods for ionizing a gas are the following: (1) exposure to high temperature, e.g., the gases rising from a Bunsen flame are conductors; (2) passage of a spark in the neighborhood; (3) exposure to Röntgen rays or to rays from a radioactive substance, such as uranium (q.v.); (4) exposure to "cathode rays" (see below); (5) exposure to "ultra-violet light." (See LIGHT.) One most important fact which seems to be established is that the negative ions of all gases, however these ions are produced, are identical. It can be proved also that the negative ions have less mass than the positive ones. For a full discussion of the recent work on this subject, reference must be made to J. J. Thomson's *The Discharge of Electricity through Gases* (London, 1902) and to publications by Professor Thomson and his students in the *Philosophical Transactions* (ib., current). See IONIZATION.

One of the most striking illustrations of the passage of electricity through a gas is afforded when the gas is inclosed at low pressure in a glass tube into which enter two metal wires serving as anode and cathode. When the gas is at a pressure of a few centimeters of mercury, and a discharge of electricity through the tube is produced by an induction coil or by a number of cells, the gas near the anode is apparently arranged in colored striations across the tube, while near the cathode there is a dark space and over the cathode itself there is a velvety glow. (The light emitted from the tube is characteristic of the gas inside. See SPECTROSCOPY.) As the tube is exhausted further, so that the pressure of the gas decreases, the dark space round the cathode extends through the tube. Finally, if the exhaustion is continued, the character of the phenomenon is changed by the gradual appearance of the cathode rays. These are streams of minute particles of matter negatively charged, which leave the cathode perpendicularly and proceed in straight lines through the gas in the tube. These cathode rays are themselves invisible, but they produce luminous effects where they pass through the gas and where they strike the walls of the tube; at this last place they produce thermal effects also. They produce mechanical motion if they strike any small movable object in the tube. Their path can be deflected by a magnet, proving that they are negatively charged particles moving with great speed—about 25,000 miles per second. If at the end of the tube on which the cathode rays strike there is a small opening covered with a thin sheet of aluminium, similar rays are observed outside the tube. These were first observed by Lenard and are called "Lenard rays." Cathode rays affect photographic plates; and, further, wherever they strike any solid obstacles, disturbances in the ether are produced, which in turn cause other radiation. These were discovered by Röntgen and are called "Röntgen rays," or "X-rays" (q.v.). The best discussion of cathode rays is given in *Les rayons cathodiques*, by Villard (Paris, 1900).

**Laws of Steady Electric Currents.** Advantage is taken of the action of an electric current in a magnet to define a "unit current." A unit pole in magnetism is defined as such a pole that, if two of them are at the distance of one centimeter apart in a vacuum, the force between them

will be one dyne. A unit current is defined as being one of such intensity that, if it is passing through a wire bent into the form of a circle of radius one centimeter, the force due to it on a unit pole at the centre of the circle is  $2\pi$ , where  $\pi = 3.14159$ . This unit is called the "C. G. S. electromagnetic unit"; and it has been shown by experiment that its ratio to the "C. G. S. electrostatic unit" is  $3 \times 10^{10}$ . A current of intensity 2 around the same circular circuit would produce the force  $4\pi$  on a unit pole at the centre; and experiments show that if a current of intensity  $i$  is passed around a circular circuit of radius  $r$  centimeters, the force on a unit pole at the centre is

$$\frac{2\pi i}{r}.$$

If there are  $n$  turns of wire making up a flat coil of radius  $r$ , the force on a unit magnetic pole placed at the centre is

$$\frac{2\pi ni}{r}.$$

The "dimensions" of a magnetic pole are  $M^{\frac{1}{2}}L^{\frac{3}{2}}T^{-\frac{1}{2}}\mu^{\frac{1}{2}}$  (see MAGNETISM); and since the force on a pole of strength  $m$  due to an electric current as just described is  $\frac{m2\pi i}{r}$ , the

dimensions of this fraction must be those of a force, i.e.,  $MLT^{-2}$ . Since the dimensions of  $m$  are given and  $r$  is a length,  $i$ , the current strength, has the dimensions  $M^{\frac{1}{2}}L^{\frac{3}{2}}T^{-\frac{1}{2}}\mu^{-\frac{1}{2}}$ . Therefore, on the C. G. S. electromagnetic system, an electric quantity has the dimensions  $M^{\frac{1}{2}}L^{\frac{3}{2}}\mu^{-\frac{1}{2}}$ ;  $\mu$  in these expressions represents the dimensions of magnetic permeability, or inductivity, as it is called.

If a small "needle" is pivoted at the centre of a coil, its axis in the plane of the coil, there will be a couple (q.v.) acting on the needle tending to make it turn at right angles to the coil. This couple may be balanced against a couple due to the earth's field of magnetic force; and in this manner the current strength  $i$  can be measured in terms of the earth's field of force. Such an instrument is called a "galvanometer," because it measures a steady electric current. By means of it Faraday's laws of electrolysis may be verified. The number of grams of any substance liberated each second when a unit current passes through an electrolyte is called the "electrochemical equivalent" of that substance. The values of this quantity for some elements are given in the following table:

Hydrogen . . . . .	0.000104
Oxygen . . . . .	0.000829
Copper . . . . .	0.003290
Zinc . . . . .	0.003385
Silver . . . . .	0.011180

The number of tubes of magnetic induction (see MAGNETISM) which pass through any coil of wire when it carries a unit electric current is called its "coefficient of self-induction"; and the number of tubes which pass through a second coil of wire owing to this unit current in the first coil is called the "coefficient of mutual induction" of the two coils. It may be proved that this same number would pass through the first coil if there were a unit current in the second. These coefficients of self and mutual induction—sometimes called simply "the induction"—are mathematical functions of the

and shape of the coils, of their relative positions, and of the surrounding medium, but are independent of the currents. If  $L_1$  is the coefficient of self-induction of one coil, and  $M$  that of mutual induction between it and a second coil, and if currents of intensities  $i_1$  and  $i_2$  respectively are flowing in the two coils, the number of tubes of induction through the first coil is  $Li_1 + Mi_2$ .

If the electromotive force applied to the terminals of a metal wire is varied, and the corresponding current measured, it is observed that one bears a constant relation to the other. If  $i$  is the current strength and  $E$  the electromotive force,  $E = Ri$ , where  $R$  is a constant for the given wire, and is found to vary directly as the length of the wire and inversely as its cross section, and to be different for different metals or for the same metal at different temperatures.  $R$  is called the "electrical resistance" of the given wire at whose terminals the E. M. F.  $E$  is applied. This law connecting  $E$ ,  $R$ , and  $i$  is called "Ohm's law."

The heating effect in the conductor has been shown to be  $Eit$ ; and so this may be written  $i^2Rt$ , showing that the effect is the same for a plus as for a minus current, i.e., it is independent of the direction of the current.

**Measurement of Electrical Quantities.** As already explained, the intensity of an electric current may be measured in terms of the earth's magnetic force by a galvanometer, and the value of this force may be determined by suitable measurements. (See MAGNETISM.) Thus the numerical value of any current on the C. G. S. electromagnetic system may be obtained. (There are other and better methods, depending upon the attraction of two parallel coils of wire carrying currents.) The intensities of two currents may be compared by making them pass through a voltmeter (q.v.) and then applying Faraday's first law of electrolysis. To measure the electrical resistance of a conductor the simplest method—at least theoretically—is to measure by means of a calorimetric experiment the heating effect in it produced by passing through it a current whose intensity is measured. The heating effect is  $i^2Rt$ ; and, as both  $i$  and  $t$  are easily obtained,  $R$  can be calculated. This will be its numerical value on the C. G. S. electromagnetic system. To compare the electrical resistances of different conductors, the simplest and most accurate method is the use of "Wheatstone's bridge" (q.v.). If the resistance of a given conductor is known, and if the current produced through it by any E. M. F. can be measured, the numerical value of this E. M. F. is given by Ohm's law. Methods for the comparison of different electromotive forces are described in all textbooks on physics and electricity. Owing to the inconvenient nature of the units of resistance and of electromotive force on the C. G. S. electromagnetic system, other units have been adopted for practical use. See ELECTRICAL UNITS.

The "ampere" (q.v.), or practical unit of current, is one-tenth the C. G. S. electromagnetic unit; the "ohm," or practical unit of resistance, is substantially  $10^9$  C. G. S. electromagnetic units; the "volt," or practical unit of electromotive force, is substantially  $10^8$  C. G. S. electromagnetic units.

**Induced Electric Currents.** If the magnetic field enclosed by any conductor, e.g., a wire bent into a closed circle, is varied in any way, there

will be produced in the conductor an electric current, which continues only while the change goes on. This is called an "induced current," and it is said to be due to an induced E. M. F. If there was a current in the conductor originally, it will be either increased or decreased, depending upon the direction of the induced current. This last is in such a direction that by its electromagnetic action it will oppose that change in the magnetic field which produces it. Thus, if the change is due to the approach of a magnet having its north pole foremost, the induced current will be such as to cause the repulsion of the north pole; while, if the change is due to the removal of the north pole of the magnet, the induced current will be in the opposite direction. The change in the magnetic field may be due, also, to the approach or removal of electric currents, to the change in the intensity of neighboring currents, or to changes in the original current in the conductor itself. Special cases of this last kind are afforded when a conductor carrying a current is broken, and also when the broken parts are reunited, thus again starting the current. In the former case the magnetic field starts at once to decrease; and owing to this there will be an induced current tending to neutralize the change in the magnetic field, i.e., in the same direction as the original current; this is shown by the spark which passes between the ends of the conductor where the circuit is broken. (This "extra current on breaking" is used often to produce a shock in the muscles of the arms or body; for, by increasing the magnetic field of the original current by winding the wire in a helix, a powerful shock may be felt.) When the circuit is again made, if the current regained its original value at once, there would be a sudden increase in the magnetic field; as the field increases, however, there are induced currents tending to oppose the change, and hence the current regains its former value at a rate depending on the self-induction and the electrical resistance of the conductor—a very short time, however, in general is required. In all cases the induced E. M. F. (and therefore the intensity of the induced current) varies directly as the change in the tubes of magnetic induction, and inversely as the time taken in which to accomplish this change. The induced E. M. F. equals the change in the number of tubes of induction in one second. In fact, the simplest way of defining a unit of self or mutual induction—or "unit induction"—is to say that it is the induction in a circuit when the induced E. M. F. in it has the value one, while the inducing current varies at the rate of one unit per second. For, if  $M$  is the coefficient of mutual induction between two coils, and if a current  $i$  passes through one, there are  $Mi$  tubes through the other; therefore, if the current  $i$  varies at the rate of one per second,  $Mi$  will vary at the rate of  $M$  per second; but the induced E. M. F. equals the rate of variation of  $Mi$ , i.e., equals  $M$ ; so, if the induced E. M. F. is unity,  $M$  must equal one. The energy required to produce the current comes from whatever agency changes the magnetic field, except when a current is made or broken, i.e., except cases involving self-induction. On breaking a circuit which carries a current, the cell or other source of E. M. F. ceases to furnish energy; and that required for the "extra current" comes from the surrounding medium; so this current continues only so long as this sup-

ply lasts. This energy of the medium is associated with the magnetic field around the conductor due to the current. Similarly, when a current is "made" by joining the two ends of the broken conductor, the cell or source of E. M. F. begins to furnish energy; and this is spent in two ways at first, in producing the magnetic field and in  $i^2Rt$  resistance of the conductor. When the current rises to its full value, as given by Ohm's law, the magnetic field reaches its final value, and all the energy now goes to overcoming the resistance ( $i^2Rt$ ). This energy of a magnetic field—around either a current or a permanent magnet—is undoubtedly kinetic; the ether and the portions of matter, if they are magnetic, are in motion. Clerk-Maxwell has shown how magnetic actions can be explained if a line of magnetic force is a linear vortex, the ether and the very small portions of matter spinning around this line as an axis, and if these different vortices are made to depend on one another by means of some kind of mechanism connecting them.

The applications of induced currents are almost too numerous to mention: earth inductors to measure the direction and intensity of the earth's magnetic field; induction coils to produce sparks, etc.; transformers as used commercially to reduce or increase the E. M. F. of currents; all forms of dynamos; the telephone; all apparatus that depends upon the use of alternating currents, etc.

**Alternating Currents and Electrical Waves along Conductors.** If the E. M. F. impressed upon a conducting circuit is not constant, the current will vary and there will be complications owing to the induced currents. In particular, if the E. M. F. is periodic in the same way that the motion of a pendulum is periodic, i.e., if it rises to a maximum, decreases to zero, becomes negative, reaches a maximum negative value, increases to zero, then to its positive maximum, etc., according to the formula  $E = E^0 \cos pt$ , the E. M. F. and the current are the simplest cases of "alternating" electromotive forces and currents.  $E^0$  is the maximum E. M. F., and the number of times the E. M. F. makes a complete period in one second is  $p/2\pi$  (where  $\pi = 3.14159$ ). If the conductor to which this alternating E. M. F. is applied is not too long, the intensity of the current in all parts of it will be the same at any one time; but if the conductor is many miles long—like an ocean cable, or a telephone or telegraph line over long distances—the E. M. F. and the intensity of the current will vary from point to point in such a way that there is a wave of E. M. F. and of current in the conductor. (These facts are perfectly analogous to the phenomena observed on shaking sidewise periodically one end of a short rope or of a long stretched rope.) The rate of transmission of the electrical waves along the conductor depends upon the properties of the conductor and the surrounding medium; and it can be proved that the rate at which the amplitude of the wave—i.e., the maximum value of the current at any one point—decreases owing to absorption of the energy of the waves varies with the wave length. Long waves, i.e., those for which  $p$  is small, die down more slowly than short waves, for which  $p$  is large. It is owing to this fact that long waves travel farther than short ones, and therefore, on ocean cables very long electrical waves are used. A discovery made in 1900, by Professor Pupin of Co-

lumbia University has shown a method by which a special kind of conductor—one in which coils of wire are introduced at regular distances—will convey all waves (within certain limits) to the same distance and will convey them much farther than will an ordinary wire or cable.

**Hall Effect.** One of the most important effects of a magnetic field on an electric current is observed when a thin sheet of metal, e.g., gold foil, is traversed by an electric current and is held between the poles of an electromagnet. When there is no magnetic field, the current flows through the sheet in a definite manner; and it is possible to find pairs of points on opposite edges of the sheet which have the same potential: this can be done by joining one terminal of a galvanoscope to one edge and then joining the other terminal to such a point on the other edge that there is no current through the instrument. If now the electromagnet is made to produce a field of magnetic force perpendicular to the sheet, there will be a steady current through the galvanoscope. If the magnetic field is reversed, so is this current. This effect was first observed by E. H. Hall in 1880 and is called the Hall effect. The action is exactly as if, owing to the " " field, the line joining the two points  $\dots$  edges, which were at the same potential, were rotated slightly around an axis parallel to the lines of magnetic force. This action varies greatly for different metals, both in direction and amount, and is proportional to the strength of the magnetic field and to the current strength in the sheet.

**Faraday Effect.** Faraday observed in 1845 that, if a beam of plane polarized light is passed through a hollow iron rod forming the core of an electromagnet, the plane of polarization (see LIGHT) is rotated when the current is passed around the helix forming the magnet. The rotation is in the direction of the current in the helix; i.e., it obeys the " " law." The amount of the " " with the material which c " " the hollow iron core and " " intensity of the magnetizing current.

Both the Hall and Faraday effects are evidences of the rotatory action around a magnetic field of force.

**Bibliography.** While the bibliography of electricity is extensive, the subject will be found fully treated in the larger textbooks of physics. Of the reference books dealing exclusively with electricity and magnetism the following are recommended, and for the convenience of the reader are grouped in three classes: MATHEMATICAL AND ADVANCED TREATISES: Clerk-Maxwell, *Electricity and Magnetism* (2 vols., London, 1881); Webster, *The Theory of Electricity and Magnetism* (New York, 1897); Thomson, *Notes on Recent Researches in Electricity and Magnetism* (London, 1893). ELEMENTARY TEXTBOOKS: Thomson, *Elements of the Mathematical Theory of Electricity and Magnetism* (London, 1895); Gerard, *Electricity and Magnetism* (New York, 1897). ELEMENTARY AND DESCRIPTIVE WORKS: Perkins, *Outlines of Electricity and Magnetism* (New York, 1896); S. P. Thompson, *Elementary Lessons in Electricity and Magnetism* (ib., 1881, 1902); Gordon, *Physical Treatise on Electricity and Magnetism* (2 vols., London, 1883); Glazebrook, *Electricity and Magnetism* (Cambridge, Eng., 1903); Starling, *Electricity and Magnetism* (London, 1912); Poynting and Thomson, *Electricity* (ib., 1914).

**ELECTRICITY, ANIMAL.** The property in animal tissues, as nerves and muscles, to produce electrical reactions. It is exhibited especially in various rays, eels, etc. See **ELECTRIC FISH**.

**ELECTRICITY, ATMOSPHERIC.** See **ATMOSPHERIC ELECTRICITY**.

**ELECTRICITY, MEDICAL USES OF.** Three forms of electricity are used in medicine: static, galvanic, and faradic. Static electricity is obtained from a frictional machine in which glass plates are rapidly revolved against chamois rubbers or horsehair brushes. The electricity is produced in a succession of sparks, which may be received in a Leyden jar or in the body of a patient insulated by being placed on a glass-footed chair. Static electricity has but little quantity, but an enormous electromotive force; the current has high potential and high frequency, but is devoid of appreciable electrolytic effects. Its use in medical practice is to modify and regulate functional processes, including secretion, excretion, sleep, circulation, and nutrition; in subacute or chronic inflammatory conditions, neuroses, paralyses, muscular contractions, skin affections, cancer, tuberculosis, etc.

High-frequency currents are now extensively used for relieving pain, increasing metabolic changes either locally or generally, reducing the blood pressure, and increasing elimination. An alternating current is derived primarily from a transformer or induction coil and is produced by the continuous charging and discharging of a pair of Leyden jars or condensers. The charge is received by the inner coating of the jars, and the current allowed to spark between metallic balls connected with this inner coating. The oscillations thus produced are estimated at a million per second. The patient does not receive this current directly, but it is first passed from the outer coating of the condensers to an Oudin resonator or Tesla coil, which increases the voltage from hundreds of thousands to over a million volts. The patient experiences only a sensation of warmth when glass vacuum electrodes are employed in the application; with metal electrodes a spark results, which is often utilized for destroying abnormal tissue.

Galvanic electricity is obtained from a galvanic battery, composed of several cells connected in the usual way, the terminal wires being inserted into metal binding posts, to which electrodes are fastened. The elements used are zinc and carbon immersed in a solution of bichromate of potash containing sulphuric acid and also a salt of mercury. A current controller, or switch, is so arranged that one, two, three, or more cells may be used at a time, according to the strength of current desired. The electrodes, or terminals, which are applied to the body, are composed of metal disks, covered with sponge and insulated so as to be grasped by the wooden handles by the physician without drawing off the current. The sponges are wet before applying. Galvanism causes a contraction of the muscle against which the electrode is applied, on application and again on withdrawal. During the interval of application there is a sensation of heat (also of pain if the amperage be great) and of tingling. A sensation of light, a metallic taste, or a buzzing sound is experienced when the current is passed through the retina, the tongue, or the ear respectively. Galvanism is applicable in treating

very many conditions and diseases of the nervous system as well as of the greatest use in the treatment of these diseases.

Faradic current is obtained from a faradic battery. An important part of this apparatus is a small induction coil consisting of a core of short, straight, soft iron wires of large diameter, around which are coiled many feet of wire. Through the wire is run an electric current which when interrupted causes an induced current to flow in a second and surrounding coil and turns the iron core into an electromagnet. Passing through the coil to the spring support of the vibrator, the current goes thence to the platinum point on the interrupter and thence back to the cell, completing the circuit. But as the current, in passing through the coil, makes the iron core an electromagnet, it furnishes the energy that attracts the hammer on the spring support, which, drawn to the magnet, breaks the circuit in leaving the platinum point of the interrupter; the current then ceases, the iron core loses its magnetism, the spring ceases to be attracted to the iron core, and its tension causes it to return to its former position, in which it touches the platinum point of the interrupter again, and again the circuit is closed. Thus, the circuit is made and broken with extreme rapidity and frequency. The secondary coil is insulated from the primary coil, and its terminals are connected with the electrodes. The rapid making and breaking of the current in the primary produces an induced current in the secondary which can be regulated at will by the operator. This induced current is applied to the human body by means of electrodes, as in the galvanic battery. The effects of faradism are wholly electrotonic. It is useful in mild cases of spinal and peripheral paralysis. Changes of circulation or of molecular state may be excited in central organs by reflex irritation produced by faradism. General faradism is beneficial in gout and rheumatism, myalgia (muscular rheumatism), in widespread eczema, in constipation due to indigestion, in hypochondria, hysteria, and neurasthenia. Local faradism is beneficial in but few cases which are not ameliorated in larger measure by galvanism. Faradism is useful in testing conditions of muscles; but here, too, galvanism is of greater value. Special electrodes of various shapes are used in applying the current to different parts of the body. A flat oval electrode, about 6 by 4 inches, is useful in applications to the abdomen or spine; a small pointed electrode, for singling out one muscle of a small area or testing a nerve; a small oval bean-shaped electrode, fastened to a rubber-covered wire, for swallowing in order to electrify the interior of the stomach; an electrode shaped like a knitting needle, with all but a half-inch of the tip insulated, for intrauterine use; a wire brush, for special use with the faradic current, etc. An interrupting electrode is so made that with the thumb of the hand that applies the electrode the circuit may be closed and opened at will for testing accurately. A special electrode is arranged for the insertion in its extremity of blotting paper saturated with a drug in solution, which is carried into the skin, when a current is passed, using this as the cathode. This is called the cataphoric electrode. A galvanic battery is furnished with a device by which the current may be run in different directions by moving a switch, thus altering the polarity of an elec-



trode without moving it. This is especially useful in testing for degeneration in a muscle. Normally the cathodal closure contraction of a muscle is greater than the anodal closure contraction. If degeneration has occurred in a nerve supplied to a muscle, the anodal and cathodal closure contractions may be equal, or the anodal may be greater than the cathodal. Faradic contractility is less in a muscle supplied by a nerve than in one in a normal means of the cataphoric electrode a medicine like iodide of potassium may be used locally in definite quantity, as in a glandular enlargement; or cocaine may be applied over the painful spot in a neuralgia or neuritis, or may be applied to the gum of a sensitive tooth before filling or extraction.

Besides the use of electrization in several diseases, as stated under their own titles, in paragraphs on treatment, galvanization is of immense value in exercising paralyzed muscles, securing their nutrition, and preventing their atrophy until relief of the central condition has been accomplished or regeneration of nerves been secured. In surgery the electrolytic action of the galvanic current is employed in destroying tumors; in destroying atrophied tissue, as in the nasal polyp; in removing naevi and birthmarks, or superfluous hair, etc. The galvanic current is also utilized in heating a cautery for searing a surface or area, to secure a cicatrix; for causing counterirritation, etc., its utility over the ordinary or Pacquelin's cautery being largely due to the fact that it can be placed in position when cold, and instantly heated to the required degree by passing through it a current of known strength. For further information, consult: *Electricity in Medicine* (New York, 1904); Guilleminot, *Electricity in Medicine* (ib., 1906); article "Electricity," in Gould and Pyle's *Cyclopedia of Medicine* (Philadelphia, 1912); Martin, *Practical Electro-therapeutics* (St. Louis, 1912); Neiswanger, *Practical Medical Electricity* (18th ed., Chicago, 1912); *Medical Electricity* (6th ed., Philadelphia, 1913). See DENTISTRY.

**ELECTRIC-LIGHT BUG.** See FISHKILLER.

**ELECTRIC LIGHTING.** Illumination produced by the conversion of electrical energy into light, usually through the agency of either arc or incandescent lamps. The electric current is generated by dynamos driven by steam, gas, or water power, and may be either alternating or direct current and of either high or low potential. In its broader sense the term "electric lighting" includes the operation of agencies for the production and distribution of electric current as well as electric illuminants. The arc light is produced when an electric current flows through a bridge of vapor or arc between two conductors, called electrodes. (See ELECTRIC ARC.) The incandescent lamp has a filament of carbon or of refractory metal mounted in an exhausted glass bulb. The resistance of this filament to the flow of current causes a transformation of electric energy into heat of such an intensity that the filament glows with brilliant incandescence.

**Early History.** The credit for the basic discovery of the electric light is probably due to Sir Humphry Davy, who in 1810 observed the electric arc and produced the incandescence of a fine platinum wire in connection with his famous experiments with a 2000-cell battery. The developments of the following 50 years were

solely of a scientific nature, as the dynamo machine had not been invented. In 1862 an arc lamp was installed in a lighthouse at Dungeness and supplied with current from a cumbersome magneto-electric machine. This light was in use for many years and is generally credited with being the first electric lamp in regular service. Gramme's dynamo of 1870 opened a new era in electrical development, yet there were but two exhibits of electric lighting at the Centennial Exposition of 1876. In 1878 Paul Jablockhoff's "electric candle" created a great sensation at its initial exhibition in Paris. He placed two carbons vertically, side by side, in a bed of kaolin between, and so dispensed with a feeding mechanism, which previously had been the source of great difficulty in arc-lamp construction. The arrangement proved unsuited to extensive use. In the same year Charles F. Brush, of Cleveland, devised a complete system of arc lighting, including a special form of dynamo and a type of self-regulating arc lamp for series operation. The Thomson-Houston system and a number of others followed very shortly. The Brush system with minor modifications is still in extensive use.

The Edison incandescent electric lamp was first exhibited in 1879 at Edison's laboratory in Menlo Park, N. J. Edison's invention comprised a complete system of generation and distribution at constant potential, with the current subdivided between the several circuits and lamps, as well as the first practicable incandescent lamp. The basic principles employed by Edison had long been known, but he was the first to surmount the enormous experimental difficulties in the development of a practicable lamp and the agencies for its energy supply. The Pearl Street Edison Station in New York was put in service in 1882 and was the forerunner of the great central stations of to-day. Of the previous attempts at incandescent lamps the most promising was described in a British patent issued in 1845 to an American named Starr, whose early death at the age of 25 rendered his work abortive. Until 1885 little use was made of alternating current for electric lighting. The invention of the transformer in that year made possible the transmission of electric currents at higher potentials than could be applied directly to the lamps and so opened the field of electric lighting in regions remote from generating stations. Later developments have multiplied the varieties of incandescent and arc lamps and have wonderfully increased the flexibility and range of electrical generation and transmission.

**Central Station** is a term used to designate a plant at which electric current is generated to supply many consumers, while an *isolated plant* supplies the wants of a single building or a contiguous group of buildings. The developments of high-voltage power transmission have made it possible to supply electric service at great distances. A notable example is found in the group of power stations at Niagara Falls, from which transmission lines radiate to many cities for the supply of lighting and power services. In some instances these cities are more than 200 miles distant. (See POWER TRANSMISSION.) The central stations in large American cities are for the most part steam-generating plants, and many of them are of enormous capacity. The largest electric-lighting system in the world is that of the Commonwealth Edi-

son Company of Chicago. This system is supplied by a group of four stations having an aggregate capacity of 320,000 kilowatts, or 430,000 horse power. The largest single generating unit in the world, a steam turbogenerator of 35,000 kilowatts, is employed in the Fisk Street Station of this company. The greater part of the output of these stations is distributed in underground cables at 9000, 12,000, or 20,000 volts to 41 substations, where it is converted to a form adapted to local needs.

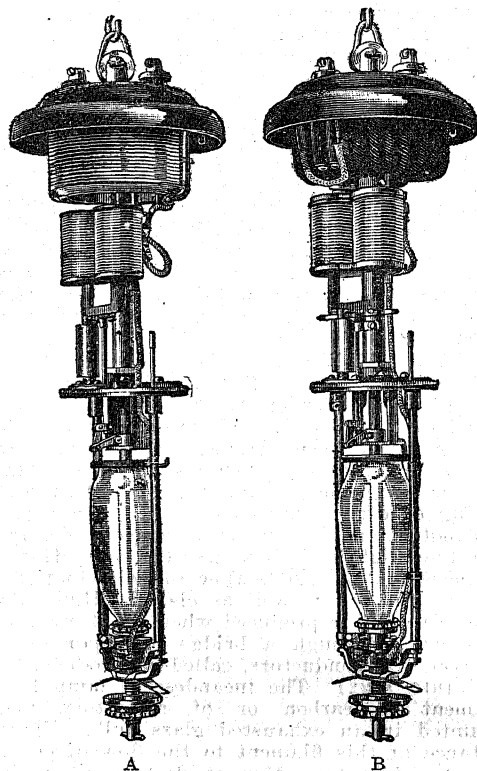
**Distributing Systems** are for the most part of copper wire, but aluminium has an extensive use, especially in long-distance transmission. The conductivity of copper is about double that of aluminium, but, owing to its lower density, an aluminium conductor weighs only 61 per cent as much as one of copper having the same length and resistance. Aluminium is at a disadvantage for use in cables, owing to the greater space which it occupies and the larger surface to be insulated as compared with copper. In the central districts of the larger cities overhead wires have now been quite generally replaced by underground cable systems in conduits. The underground system is safer and less liable to accidental injury, but its initial installation is much more costly than a system of overhead wires. In many districts the latter have been banished by legislative action in the interests of public safety and convenience. (See CABLE, ELECTRIC; POWER TRANSMISSION; SUBWAYS.) Distributing systems divide broadly into two basic types, viz., *series*, constant-current, and *parallel*, constant-potential, which in practice are often complicated by various combinations.

In the simple series system the current passes from the dynamo through each lamp successively and returns to the dynamo without subdivision at any point. The current is usually maintained constant by automatic regulating devices, but the voltage or potential is varied according to the number of lamps and the resistance of the circuit. An extensive series circuit may supply 150 arc lamps with a current of from 4 to 10 amperes and require a voltage as high as 12,000. Parallel systems employ constant potential, but the current is subdivided among all the lamps and other receiving devices and varies according to the number in use. In the parallel system each lamp or group of lamps is controlled separately, whereas series circuits are usually thrown on or off as a whole. The usual supply voltage of parallel systems is between 100 and 125 volts. The parallel system is extremely flexible and safe, but has the disadvantage of requiring a large aggregate weight of conductors. The series system is well adapted to systems where all the lamps are controlled simultaneously and where high voltage conductors can be safely installed. Its greatest use is for street lighting. Suitable arc and incandescent lamps of all types are available for both systems.

The parallel system is in practically universal use for general power and lighting supply. Current may be furnished by either direct- or alternating-current generators, though the former are now used chiefly in small isolated plants. Most of the direct-current supply in large cities is confined to the central districts and is obtained from substations where alternating current is received at high potential and converted by dynamo machines to direct cur-

rent. Direct current is commonly distributed by a three-wire system, which is equivalent to two two-wire circuits with a common conductor. When the two component circuits carry equal currents, little or none flows in the common wire, and the voltage drop is due only to the resistance of the outer wires. All three wires may therefore be made much smaller than in two separate circuits, and a saving of from 25 to 70 per cent is possible, depending on the degree to which balanced loads can be guaranteed. Alternating current is usually generated at a voltage of 2300 or higher and is delivered over relatively small transmission wires to transformers placed at important load centres, where it is stepped down in voltage and delivered to the lamps by a secondary system of conductors.

**Arc Lamps.** The essential elements of an arc lamp are a pair of electrodes, the regulating devices needed to establish an arc and feed the electrodes as they are consumed, and the necessary connections to an external circuit. Arc lamps are generally designated by the type of electrodes employed, as carbon, flame carbon, metallic oxide, and mercury arcs. Arcs are also divided into series and parallel types according to the system of distribution to which they are adapted. Distinction is also made between open arcs and inclosed arcs, according as the arc is



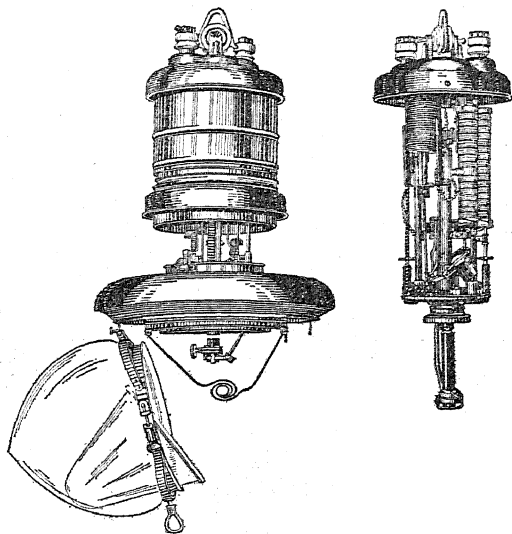
INCLOSED ARC LIGHT.

A. Direct current. B. Alternating current.

operated with free or with restricted access of air.

The ordinary carbon arc has long cylindrical electrodes prepared from petroleum coke, gas coke, or lampblack. The raw materials are successively crushed, roasted, powdered, and bolted.

then are mixed with hot pitch; this compound is allowed to cool, and is then powdered, reheated, and formed in molds or forced through dies into cylindrical form, and is finally baked. The better grade of carbons are usually forced.



INCLOSED FLAME ARC LAMP.

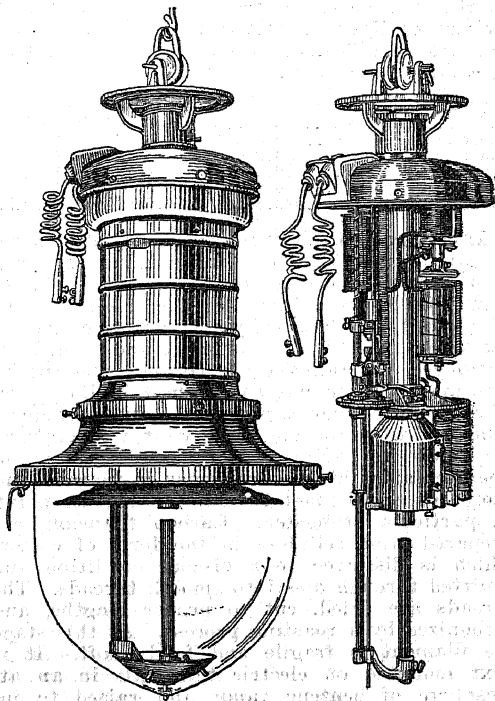
In some cases a cored carbon is produced by filling an axial hole in the carbon with a mixture of powdered carbon and salt. This mixture volatilizes more readily than the basic carbon and so improves the steadiness of the arc.

Carbons for flame arcs are strongly impregnated with mineral salts. Calcium salts are employed when an orange light is desired and barium salts for white. The ordinary carbon arc owes its light chiefly to the incandescence of the ends of the electrodes, and its arc stream is of a feeble bluish color. The mineral salts vaporized into the flame arc impart to it a brilliant luminescence and greatly increase its luminous efficiency. Both types of carbon arc can be operated by either direct or alternating current, while other types of arc operate with direct current only.

The metallic oxide or magnetite arc has a positive electrode of copper, which remains inert and is not consumed to maintain the arc. The active or negative element is a mixture of oxides of iron, titanium, and chromium powdered fine and packed in an iron tube. This mixture produces an arc flame of very white color and excellent efficiency. The mercury arc, commonly called the mercury vapor lamp, can be produced only in highly exhausted glass or quartz tubes. Its greenish color is due to the peculiar spectrum of mercury vapor, which is strongly deficient in red rays. The low-pressure arc in a long glass tube produces light of moderate brilliancy at low temperature. The high-pressure arc develops a temperature sufficient to soften glass and requires a quartz tube. The high-pressure arc produces some red rays and is of fairly high brilliancy.

Regulating devices are required to feed the electrodes of arc lamps so that the arc is maintained constant in length and candle power. Ordinary carbon arcs are provided with stationary lower electrodes. The upper carbon is held

by a clutch and feeds downward by gravity whenever this clutch is released. The clutch is controlled either by a train of wheelwork, an electrical or mechanical motor, or by solenoids. The solenoid mechanism is now almost universally used. The clutch is often a simple collar, which is released when the arc burns to a certain length and resistance. The slip of the carbon is checked by the lifting action of the clutch when the proper arc length has been restored. The arrangement of the electrodes in flame arcs follows two different types. In the Bremer type the carbons are long and slender. They converge downward, and the arc is formed between their tips, giving a powerful downward light distribution. The carbons are fed down inclined slides by gravity, with the rate of descent controlled by a clutch regulated by solenoids. Arcs of this type produce copious fumes and must be open for positive ventilation. The life of the carbons is short, and the expense of trimming is large. The Blondel type of flame arc uses short and thick vertical carbons, both of which are fed as consumed to maintain a constant arc level and length. The usual feed device is a chain run from the top of the upper carbon over a pulley and attached to the bottom of the lower carbon. As the arc lengthens by the burning of the electrodes, an electrically controlled clutch is released, the upper carbon descends, and the lower rises by equal amounts until proper arc length is restored. The more



GENERAL ELECTRIC MAGNETITE ARC LAMP. DIRECT-CURRENT-SERIES LUMINOUS ARC LAMP.

modern flame arcs of this type are tightly inclosed and have a condensing chamber in the housing above the arc into which the fumes are swept by air circulation and in which their fumes are allowed to settle out. The life of such lamps per trim is from 100 to 125 hours, or

about the same as the best inclosed carbon arcs, while the efficiency of the flame arc, viz., 0.25 to 0.6 watt per candle, is from four to five times as good as that of the carbon arc.

The regulating mechanism of the magnetite arc allows the arc to increase in length and resistance up to a certain point, then forcibly brings the electrodes together and forms the arc anew. This method of feeding is necessary for the removal of the slag, which tends to incrust the negative electrode. The tube of a mercury arc is always somewhat inclined and is provided with a condensing chamber at its upper end. The mercury is restored to the lower electrode after condensation by gravity.

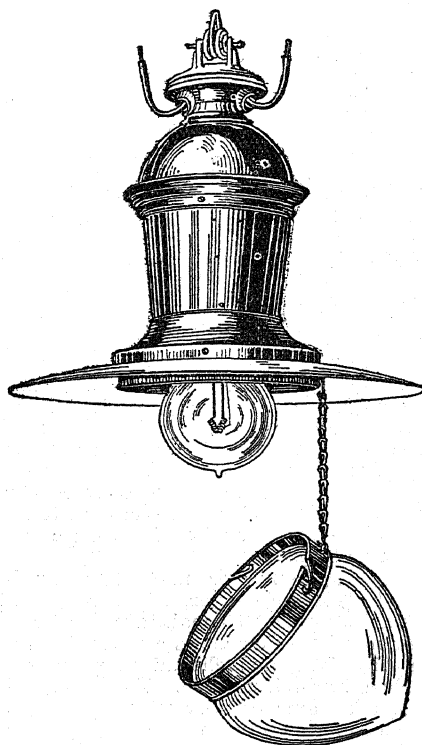
Arc lamps are essentially high-candle-power illuminants and are relatively less steady in their operation than incandescent lamps, due to the intermittent action of the feeding devices. Their greatest field of utility is in the illumination of streets and large spaces where large units are advantageous and steadiness of light not imperative. While carbon arcs are less efficient than the best incandescent lamps, many are still in use in interiors for the sake of the whiteness of their light or the rugged nature of their construction. The performance in life and efficiency of the arc lamps in commonest use are given in round numbers in the accompanying table. The candle power is a misleading unit of light output, as it may refer to the intensity of light in a single direction or in the mean of many directions. The following data are based on the average candle power in the lower hemisphere of light distribution, which is perhaps the most significant single measure of the utility of a lamp for street lighting.

Type of Lamp	Watts per candle	Life per trim
Carbon arc, inclosed....	0.7-2.0	100-150 hours.
Flame arc, open type....	0.3-0.5	10-17 "
Flame arc, inclosed....	0.3-0.5	100-150 "
Magnetic arc, open....	0.4-0.6	125-200 "
Mercury arc, glass....	0.5-0.65	1000-2000 "
Mercury arc, quartz...	0.3-0.4	2000 hours and up.

**Incandescent Lamps** are usually designated as carbon, metallized carbon, tantalum, or tungsten lamps, according to the nature of their filaments. The material of the filament must of necessity be electrically conducting, extremely refractory, mechanically strong, and capable of prolonged incandescence without destructive wasting. Carbon has the highest boiling point of all known conductors, but has an unfortunate tendency to evaporate rapidly at temperatures far below its boiling point; hence it cannot be operated at as high an efficiency in incandescent lamps as certain metals of lower melting point, in particular tungsten. Carbon filaments are prepared from cellulose in the form of cotton, which is dissolved to a viscous condition and squirted through dies into smooth threads. The threads are dried, cut to proper lengths, and carbonized by a roasting process. At this stage the filament is fragile and fairly soft. It is next mounted on electric terminals in an atmosphere of benzene vapor and raised to incandescence by a carefully regulated electric current. The heat of the filament decomposes the benzene vapor and causes a shell of hard graphitic carbon to collect on its outer surface and to correct any irregularities in its diameter and resistance. The metallized carbon filament is produced by a process similar to that outlined, but it is treated to a process of baking in an electric furnace before and after the

"flashing process." The physical changes produced by this heat treatment greatly increase the strength, conductivity, and durability of the carbon at high temperatures.

With the general adoption of tungsten metal as a filament material, the use of carbon filaments of both types has very greatly declined. Tungsten has a very high melting point, about 3200° C., and can be heated until fairly soft without rapid evaporation. It is a very dense and hard metal and can be rendered ductile only by an elaborate heat treatment. Before the commercial development of the drawing process for tungsten, filaments were produced from a paste of tungstic oxide mixed with a starchy binder and squirted through a minute diamond die. These threads were chemically reduced to pure tungsten and welded by the passage of electric current into fairly continuous wires. The drawn filaments of the present day are in all respects greatly superior to the early squirted filaments. The conductivity of tungsten is so great compared with that of carbon that the filaments of the former must be relatively long



NITROGEN-FILLED TUNGSTEN LAMP FOR STREET LIGHTING.  
1000 candle power.

and of small diameter. As the metal softens perceptibly at its operating temperature, a more elaborate form of mount is required by tungsten filaments than that used with carbon. This takes the form of a double spider of copper wires on which the filament is bent back and forth in short lengths. Series tungsten lamps for street lighting usually have a single loop of coarse wire anchored to the tip of the bulb. The tantalum filament was used in great numbers before the advent of the drawn tungsten filament, but has since practically disappeared. Its

efficiency and life were decidedly inferior to those of the tungsten lamp.

Ordinary incandescent lamps are exhausted by air pumps and by burning in each chamber a small amount of phosphorus compound. The highest practicable vacuum is sought, as slight traces of gas hasten the decay of the filament and serve to conduct away part of its heat in useless form. In some tungsten lamps of recent development a radical departure is made from all previous practice by filling the bulb with nitrogen gas. The gas serves as an active conductor of heat away from the filament and so causes a large element of loss. The gas pressure, however, retards the evaporation of the filament at high temperatures and so makes possible an increase in operating temperature more than sufficient to offset the convection losses of heat. It has not been found possible to improve the efficiency or life of small lamps by this method; hence its commercial development is limited to lamps above 100 candle power. To meet the increased difficulty in supporting the filament due to its softness, a special form of construction is employed. The filament is coiled into a tight helix of small diameter, and the distance between its ends is greatly reduced. The coiled form of filament causes less loss of heat by convection than the filament in the presence of the gas.

The method of sealing the leading-in wires to the bulb so that the expansion and contraction of the lamp as it is heated and cooled may not admit air is a matter of the highest importance. The sealed portion of the wire is a very short length of platinum, a metal whose expansive action coincides perfectly with that of the glass. Refinements of manufacture have reduced the cost of platinum per lamp to less than one cent.

The following table gives some idea of the great flexibility of the incandescent lamp and the efficiencies of various types:

Type of Lamp	Range of candle power	Useful life (hrs.)	Watts per hour's light candle
Carbon.....	4-32	600	3.1-3.5
Metallized carbon.....	15-100	800	2.0-2.5
Tantalum.....	20-40	800	2.0-2.2
Tungsten.....	1-500	1000	1.0-1.3
Tungsten (nitrogen).....	100-2000	1000-2000	.50-.75

The Nernst Lamp, invented by Professor Nernst of Göttingen, employs as a luminous element one or more rods or glowers of rare earth oxides, chiefly zirconia and yttria. When cold, these glowers are practically nonconducting, but their conductivity increases greatly when heated. An external heating coil is required to start the lamp in operation. The glowers cannot be operated in a vacuum. The Nernst lamp has gradually declined in use since the advent of the tungsten lamp.

With the developments of modern illuminants of high efficiency, much attention has been given to the artistic and scientific use of lamps. High-efficiency lamps are for the most part of excessive brilliancy and require the use of some kind of diffusing medium to soften the light. In many cases a degree of diffusion approaching that of daylight has been sought by the complete concealment of the lamps within bowls or troughs which reflect the light upward to a white ceiling, whence it is distributed about the room. Semi-indirect lighting, in which the lamps are covered by translucent bowls of glass, which partially transmit the light downward and par-

tially reflect it to a white ceiling, is considered by many a more satisfactory solution of the problem. The various diffusing agencies used with modern lamps absorb from 15 to 40 per cent of the light. Since it is not the total light output of a lamp or the brilliancy of its light which measures its value, but the useful light entering the eye from illuminated surfaces, the softening of the quality of light usually much more than compensates for absorption of light in a diffusing medium. This is especially true in street lighting, where the degree of illumination is low. See PUBLIC UTILITIES.

**Bibliography.** Crocker, *Electric Lighting* (New York, 1910); Bell, *Art of Illumination* (ib., 1913); Steinmetz, *Radiation, Light, and Illumination* (ib., 1909); Hutchinson, *High Efficiency Illuminants and Illumination* (ib., 1912); Franklin, *Electric Lighting* (ib., 1912); *Standard Handbook for Electrical Engineers* (ib., 1912); Bohle, *Electrical Photometry and Illumination* (London, 1912); *American Handbook for Electrical Engineers*, ed. by Pender (New York, 1914).

**ELECTRIC LOCOMOTIVES.** See ELECTRIC RAILWAYS.

**ELECTRIC METERS.** There are three general classes of electric meters. The first comprises *indicating meters*, such as are mounted on the switchboards of power stations and those used in making electrical measurements. Such meters show at each instant the voltage, current, power, or power factor in an electric circuit. A second group consists of *curve-tracing meters*, which trace on suitably divided charts ink-line records of the various electrical quantities enumerated above. The third group includes all devices used to record the consumption of electrical energy, technically known as *watt-hour meters*.

Indicating and curve-tracing meters exist in great variety, but their basic mechanisms are of three general types. In the *moving-coil* type a coil of fine wire is supported on pivots so that it normally stands parallel to a strong magnetic field. When a current flows in this coil, it receives a twisting impulse from the magnetic field which is opposed by a spiral spring. The actual deflection depends on the magnitude of the current in the coil. In *permanent-magnet* instruments of this class the magnetic field is produced by powerful horseshoe magnets, but in *alternating-current* meters the field is set up by fixed coils without iron cores. In the *hot-wire* type of instrument a fine wire is stretched between two terminals and is heated by the current passing through it. The wire expands according to the strength of the current and imparts a turning motion to an index needle. This type of meter is equally adaptable to direct and alternating currents. In the *magnetic-vane* type of meter a fixed coil is set with its axis inclined to a spindle carrying a light vane of iron. As current flows in this coil, a magnetic field is set up which attracts the vane and causes it to turn on its pivot in the endeavor to align itself with the strongest portion of the magnetic field. An instrument of this type may be used with either form of current.

The earliest commercial type of watt-hour meter was introduced by Edison and was based on the chemical action of an electric current. The meter consists of a cell containing a solution of zinc sulphate in which are immersed two electrode plates of zinc. A flow of current through the solution causes zinc to be dissolved

from one plate and to be deposited on the other at a rate in exact proportion to the flow of current. The weight of metal in grams so transferred in any period may be divided by 1.213 to determine the number of ampere hours of electricity which have passed through the cell. The cell usually carries a fixed fraction of the total current, the remainder passing through a German-silver shunt. The number of watt hours consumed is computed by multiplying the ampere hours recorded by the ratio of the total current to that passing through the cell and by the voltage of the circuit. Such a meter is quite accurate if properly compensated for changes of temperature. Its disadvantages are very serious and have practically driven it out of use. It is adapted only to direct current, it cannot be read directly by the consumer, and the labor of collecting and weighing plates is troublesome and costly.

Practically every watt-hour meter of the present day is essentially an electric motor whose shaft is driven at a speed proportional to the power being consumed in the system. The shaft is attached through a train of gears to the pointers of a set of dials, which usually read in tens, hundreds, thousands, and tens of thousands of kilowatts. The type of meter most used on direct-current systems is the invention of Elihu Thomson. It consists of a small commutator motor the field coils of which are of heavy wire and carry part or all of the line current. The armature consists of a number of coils of fine wire wound over a nonmagnetic form. Small copper brushes bear on the commutator and serve to connect the armature across the supply mains. The field strength is proportional to the current, and the armature current to the voltage. The torque is proportional to the product of these two or to the power being consumed. The armature shaft carries a light disk of aluminium which it revolves between the poles of strong horseshoe magnets. Foucault, or "eddy," currents are set up in the disk and serve to retard its motion. The resulting speed of revolution is therefore directly proportional to the power, and the total number of revolutions in any period is a measure of the energy or watt hours consumed in that time. The Thomson meter can be used with either direct or alternating current, but it has been largely superseded in systems of the latter type by the less expensive and simpler induction meter.

The induction meter embodies the principle of the induction motor. Its armature consists of a disk of aluminium forming a short-circuited path for currents induced by a revolving field passing through the disk. This revolving field is set up by the interaction of two sets of coils—one highly inductive and connected in shunt across the circuit, the other but slightly inductive and connected in series with the circuit. The current in the highly inductive shunt coils is very nearly a quarter cycle, or 90°, behind the voltage in phase. The magnetizing action of these coils reaches its maximum at a later time than that of the series coils and tends to create a revolving field as in a two-phase induction motor. The revolution of the disk is retarded by horseshoe magnets like those used in the Thomson meter. As the torque on the disk varies as the power in the circuit, and as the retarding force is proportional to the speed, the rate of revolution is directly proportional to the power. Two-phase and three-phase in-

duction meters consist of two single-phase elements acting on a common shaft.

A third type of meter, used to some extent in America and in extensive use abroad, is based on the fact that a current-carrying conductor is acted on by a sidewise force when placed in a transverse magnetic field. The shunt winding of this meter is an electromagnet between the poles of which is a disk of aluminium floating in a shallow chamber filled with mercury. The main current is caused to pass through the mercury chamber from side to side at right angles to the magnetic field. As a result, the mercury and disk are set in revolution. The disk carries a shaft and is retarded in its motion by horseshoe magnets. This meter may be used with direct or alternating currents, but differs from the Thomson type in that it has no wound armature and requires no commutator.

The bearings of watt-hour meters are usually jewels of diamond or sapphire to lessen the friction. The nature of such meters is to run somewhat slower with use, due to increasing friction. Cases where a meter installed in good adjustment subsequently gains in speed are relatively rare. Service regulations in many cities and States require that each meter shall be tested and adjusted not less than once each year and that each meter in service shall be accurate to within 2 or 3 per cent. In many cases the dial reading of a meter must be multiplied by a constant to ascertain the true energy consumption. The value of this constant is often printed on the face of the dial. Consult: Jansky, *Electrical Meters* (New York, 1913); Foster, *Electric Engineers' Pocketbook* (ib., 1910); *Electric Meterman's Handbook*, published by the National Electric Light Association (ib., 1912); *American Handbook for Electrical Engineers*, ed. by Pender (New York, 1914).

**ELECTRIC MOTOR.** See DYNAMO-ELECTRIC MACHINERY.

**ELECTRIC RAILWAYS.** Railways on which the cars or trains are propelled by electric power, either transmitted from central power stations or supplied by accumulators or storage batteries carried on the cars themselves. The first attempt to build an electric railway of which there is any record was made by Thomas Davenport, a blacksmith and wheelwright of Brandon, Vt., in 1835. For a motor he had a revolving electromagnet running between soft iron armatures or pole pieces, carrying upon the revolving shaft a commutator by which the direction of the current was regulated. Three years later, Robert Davidson, of Aberdeen, Scotland, built an electric locomotive for standard-gauge railway tracks which made several successful trips. In 1850 Prof. C. I. Page, of Washington, D. C., made a 16-horse-power electric locomotive which was tested on the Baltimore and Ohio Railroad and developed speed as high as 19 miles per hour. About the same time Moses G. Farmer constructed a small model electric railway, which was notable for the fact that a reduction gear from the motor shaft to the driving axle was employed, and because the current was supplied to the motor through the rails. All these early attempts at electric propulsion were made previous to the invention of the dynamo, and current had to be obtained from batteries.

In these early attempts it was realized that the expense of generating electricity in chemical batteries was too great to admit of its ap-



plication to propulsion on railways. With the development of the dynamo, and as one improvement and discovery after another was made, the fact was demonstrated that in its use lay the mean.

Electrical energy for railway propulsion was not until 1879, however, that what may be called the first working electric railway of full size was constructed. This was an exhibition line 1000 feet long, built at the Berlin International Exposition by Siemens and Halske; the motor was a Siemens dynamo connected by double reduction gearing to the axle of a car capable of carrying 20 passengers. In 1880 Thomas A. Edison and Stephen J. Gray, in America, began experimenting, but a contention between them over priority of patents delayed any real results until 1883. Meanwhile Siemens and Halske had constructed a third-rail line in Berlin and an overhead-wire line in Charlottenburg. In 1883 Werner Siemens built a third-rail line 6 miles long from Portrush to the Giant's Causeway in Ireland. Power for operating the dynamo was obtained from a waterfall operating a pair of turbine wheels.

In 1883 the Field-Edison controversy was settled by a consolidation of interests, and an exhibition line 1500 feet in length was installed at the Chicago Railway Exhibition, upon which was run an electric locomotive taking current from a third rail, with joints bonded to improve its conductivity. Later in the same year an overhead line was exhibited in Chicago by C. J. Van Depoele, and about the same time Leo Daft built a third-rail line from Saratoga Springs, N. Y., to Mount McGregor. During this time E. H. Bentley and Walter Knight built a conduit line in Cleveland, Ohio, and later one in New York City and one in Boston.

The first practical overhead-trolley line was built in Kansas City in 1884, in which double overhead conductors were used with a trolley wheel riding on top of the wire. In 1885 Mr. Daft constructed a third-rail line at Baltimore and Mr. Van Depoele installed an overhead-trolley line at Toronto, Ontario. The next step made in the development of the electric railway in the United States, and the one which did most to stimulate capitalists and inventors to the active interest which has produced the marvelous perfection in electric-railway transportation which we witness to-day, was the contract made by the Union Passenger Railway Company, of Richmond, Va., with Mr. F. J. Sprague, to equip its 13-mile system of street railways for electric traction. On Jan. 1, 1888, there were 13 electric railways with 48 miles of track in operation in the United States and Canada. There followed a period of consolidation of interests among electric-railway builders, and the modern era of electric-railway development was opened.

The history of this growth, so far as it is important to outline it, can but be given as the various modern systems of electric traction are taken up for consideration. For this purpose the subject may be divided into: (1) overhead-trolley railways; (2) conduit railways; (3) storage-battery systems; (4) electric locomotives and heavy-train systems; (5) central station construction and equipment; (6) cars and motors.

**Overhead-Trolley Railways.** In overhead-trolley lines the current for operating the cars is taken from a suspended wire conductor by means of an under-running trolley wheel carried on a trolley pole extending upward from the car roof, or, in high-speed lines, by means of an ar-

rangement of levers called a "trolley pole." The current passes down the trolley-pole conductor to and through the motor and returns to the central station by way of the rails. In a few instances double trolley lines have been constructed on which the second conductor provides

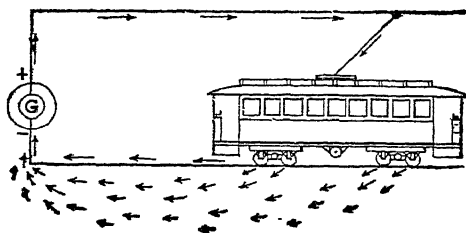


DIAGRAM OF TROLLEY-CAR CIRCUIT.

for the return current. In the three-phase trolley systems, used to some extent in Europe, two overhead conductors are required; for the third conductor the track rails are used.

Trolley-road construction may be subdivided into roadbed and track construction and overhead construction. Only a few salient features of each can be touched upon here. Street railway tracks when once laid cannot be repaired without taking up the pavement; and as this is an expensive operation, great care is taken in first putting down the tracks. Modern practice for city work where traffic is heavy is to use standard oak ties 8 feet long and impregnated with some preservative compound. A 9-foot trench is excavated and the ties spaced 2 feet on the centre. Sixty-foot rails, weighing sometimes as high as 114 pounds, are spiked in place, and ballast is dumped and tamped under the ties until the rail heads are approximately at grade. Concrete is then filled in between and around the ties and to such a point above them as will leave space for the paving. The final leveling of the rail is done just before the concrete is put in place, so that the setting of the latter will aid in maintaining the grade. If the joints have been electrically welded, engineers claim that such construction should need no repairs for from 12 to 15 years. Splice joints for electric railways resemble those of steam railways and consist of two splice plates for each joint, which are placed on opposite sides of the two abutting rails and clamped together by bolts passing through both splices and rails. The method of making cast welded joints is as follows: The rails at the joint are cleaned and brightened by a sand blast (q.v.), and a cast-iron mold is placed around the rail ends, making a tight fit. Into the mold the molten metal is poured. The metal in contact with the mold begins to cool and forms a crust, while the interior remains in a molten state. This crust continues to cool and at the same time contracts, forcing the molten metal towards the centre of the joint. The top or bearing surface is afterward filed off perfectly smooth, so that it is difficult to detect a joint by riding over it. Some engineers object to the cast welded joints because the mass of metal surrounding the joint makes it impossible to place a tie directly under, and when the joint is hung between two ties, the constant hammering of the car wheels causes a dish in the rail at this point. Electric welding of rail joints is described in the article on WELDING, while under ALUMINO-THERMICS is discussed

that process of welding as applied to electric-railway rails.

The rails being laid and the jointing and bonding finished, the pavement is laid, restoring the street to its original condition. For suburban and interurban roads a track built of from 60-pound to 100-pound T-rails spiked directly to the ties is used, the road surface being restored after all is completed.

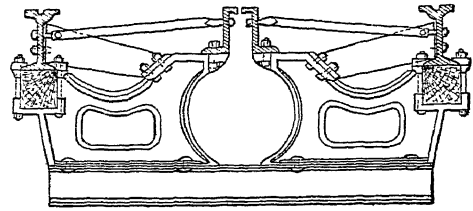
Overhead construction for trolley roads comprises the electric conductor and the structures for carrying the conductor. The supporting structure for the conductor is of two forms, usually called span wire and bracket arm. In the first the trolley wire is hung from a span wire stretched between poles on opposite sides of the track; in the second, a single row of poles is used with a bracket arm extending out over the track to carry the conductor. Often double-bracket poles placed between the tracks carry the two conductors for double-track roads. Both wood and iron poles are used, while special poles of reinforced concrete have been tried with some success.

A special form of catenary construction is employed on systems using trolley voltages over 1000. A steel messenger wire supported by bracket arms or span wires hangs over the track in a series of flat catenary curves. The trolley wire of copper is suspended from the messenger wire by metal hangers at short intervals. These hangers are accurately graded in length so that the trolley wire is at all points parallel to the track and of very nearly constant flexibility. This type of construction insures continuous contact between the trolley wire and the current-collecting device at high speeds and lessens the danger of accident from trolley-wire breakage.

In America the development of overhead construction has been in the direction of securing lightness, strength, and effectiveness at low cost, and ornamentation has not been sought. In Great Britain and continental Europe, however, fancy brackets, scrolls, and ornamental castings have been used very generally, and this is the essential difference between the practice on the two sides of the ocean. Car and central-station construction are described in succeeding paragraphs.

**Conduit Electric Railways.** Conduit electric railways are those having some form of conduit or trough below the level of the rails, either between them or at the side of the track. Usually there is a continuous opening or slot in the street, through which the "plow" projects from the bottom or side of the car. In the conduit, supported upon suitable insulators,

the slot on a wire imbedded in the plow, through the motor, and again back to the other conductor. Various other kinds of conduit systems have been devised, but the one described is



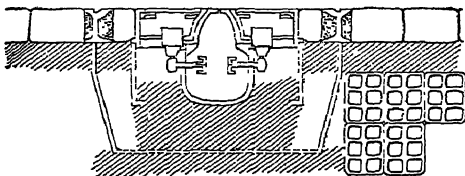
CROSS SECTION, SHOWING FORM OF YOKE AND TRACK CONSTRUCTION.

the only one which has reached any commercial success. The conduit electric railways of New York and Washington, D. C., e.g., have the conduit between the rails; the only side-conduit railway of importance is that at Budapest, Hungary.

As constructed in America, a trench about 2 feet deep at the centre and 6 feet wide is dug along the line of the road, and heavy cast-iron yokes, weighing from 400 to 500 pounds, are placed crosswise of this trench about every 4 feet. To these yokes are bolted the tracks and the rails forming the edges of the slot. Between these yokes and around them is placed concrete, with a trough in the centre to form the conduit.

Between and at the sides of the tracks at intervals of about 15 feet small covered openings are made into the conduit, and at these points heavy cast-iron and porcelain insulators are bolted to the slot rails. These have pins projecting down into the conduit, to which steel T rails are bolted. The car plows extend through the slot and have rubbing blocks which press against the conductor rails. Current is supplied to these conductors by feeders or cables which run in underground conduits alongside the track from the power station and are attached at intervals to the conductor rails. Protected by frequent outlets from the conduit to sewers, and manholes at intervals give access to the conduit for repairs. Conduit railways are far more expensive to construct than overhead-trolley lines, chiefly because of the elaborate track and conduit construction required, and because of the necessity of removing underground pipes which interfere with the conduit. The most notable conduit electric railway systems of the United States are those of New York City and of Washington, D. C., the New York system aggregating over 200 miles of line.

**Third-Rail System.** In this system, the current is conducted to the cars by means of a third rail, placed on insulators about 20 inches from the track rails. For this purpose an ordinary T rail is used, with the joints carefully bonded. This rail is connected at convenient points with the feeders from the generating station or transformer stations. This system is used on all the elevated roads and subways or underground tubes in the United States and also on many interurban roads as well as in underground tunnels, terminals, and suburban zones of such American systems as the New York Central and Pennsylvania, where electrification has been introduced. Current is taken from the rail by sliding iron contacts called "shoes", mounted on the car or locomotive. The amount of current



CROSS SECTION OF CONDUIT OF ELECTRIC RAILWAY, SHOWING THE METHOD OF SUPPORTING THE CONDUCTOR RAILS.

pins, or brackets, are the conductors, against which suitable rollers or rubbing blocks, forming part of the plow, are pressed. In this way current can be taken from one conductor up through

that can be taken from a third rail through a single contact is much greater than can be taken from the overhead trolley; hence the extensive use of this system on heavy traction roads.

**Storage-Battery Systems.** Numerous attempts were made in the early days of the art to operate electric-railway cars by means of storage batteries carried in them, but none of these attempts met with commercial success. Perhaps the most notable experiment of several made with storage-battery traction in the United States was that carried out on the Fourth Avenue Railway in New York City in 1890. Fourteen cars were equipped with 110 cells each, 55 on each side of the car, under the seats, and were run between the post office and the charging station at Eighty-sixth Street, about 5 miles. The result of these experiments led the officers of the road to conclude the system impracticable, owing to the great cost of depreciation of the batteries. The advent of the Edison nickel-iron battery later led to more successful experiments in battery propulsion. This battery is very rugged and relatively light and is capable of very rapid charging. In 1914 a considerable number of battery-propelled cars were in use in New York and elsewhere, particularly on lines where the traffic did not warrant the outlay for installing an underground conduit system or where temporary service was required.

Storage batteries, however, find a more important use as regulators in connection with the trolley or third-rail systems of propulsion, being installed in the generating station or substation of the system to prevent heavy fluctuations of load on the generators. Such batteries have been installed on a large scale on some of the largest street-railway systems of the United States, notably the Metropolitan Traction Company's conduit lines in New York City and the South Side Elevated Railway in Chicago, Ill. The New York Central Railroad utilizes an installation of storage batteries for its electric system aggregating in capacity over 20,000 kilowatts.

**High-Voltage Systems.** The early electric traction systems employed exclusively direct current at voltages not exceeding 600. As the extent of these systems and the volume of their power requirements increased, the cost of conductors for transmission at so low a voltage tended to become prohibitive. To maintain the advantages of centralized power supply and to make possible electric operation over long distances, it became the practice to generate alternating current and to transmit it at high voltage to substations, where it was converted into direct current at about 600 volts for the use of the local section of the trolley system. (See POWER TRANSMISSION.) This system of power supply is still very extensively used. The single-phase alternating-current system grew up, first in Europe and later in America, as a rival to the composite system just described, especially in the realm of main-line and interurban railways. In this system the trolley wire is supplied with alternating current at a voltage of from 3000 to 15,000. Current is taken off at the car or locomotive by means of a wheel trolley or a sliding contractor and is reduced in voltage by a transformer and controller before being applied to the motors. The alternating-current motors are also capable of operation by direct current; hence the urban sections of single-phase railways are usually

supplied with direct current at 600 volts or less. The advantage of the alternating-current system lies in the elimination of expensive substations and the high efficiency of the transmission system. The motors are in many ways inferior as motive power to those of the direct-current type. For these reasons the single-phase system has found its field on heavy railways and on long interurban systems where the power-transmission problems are predominant. A number of European trunk lines and the Great Northern system in America make use of three-phase induction motors. These are very powerful and rugged and can be operated with great economy in transmission, but they require a complex double-trolley system and are unsuited to service with frequent stops.

In recent years American engineers have given a great amount of attention to increasing the trolley voltage in direct-current systems. A number of lines now employ 1200 volts and some 2400. Still higher voltages are considered feasible. In these systems the motors are insulated for full voltage, but are usually operated in pairs so connected that each receives half-line voltage. The number of substations required is very much less than for 600 volts. To secure the economies in transmission afforded by the single-phase system in combination with the advantages of direct-current motors, numerous experiments have been conducted with locomotives carrying current rectifiers of large capacity—in some cases mercury-arc rectifiers and in others rotary converters—and driven by direct-current motors. No such systems have yet been commercially developed.

**Cars and Motors.** One or more electric motors geared to the car axles and a controlling switch on each platform constitute the principal parts of a motor-car equipment. Instead of having the journal boxes attached to the car frame, as in horse cars, the motors and running gear are attached to a car truck, on which the car body rests. The remarkable improvement which has been made in the design of street-car motors within the last 20 years is the principal cause of the success of electric railways. The first car motors were entirely too light mechanically and of too small capacity. From a single 15-horse-power motor driving one car axle, the capacity of the car equipments has been gradually increased up to the present practice of using four motors, one geared to each axle, for ordinary urban service. These motors are of various horse powers, from 25 for light service up to 225 for high-speed interurban lines. A marked improvement has also been made in the reduction of armature speeds, so that the use of a double reduction in speed by means of a countershaft and two pairs of gears between the armature shaft and the car axle is now obsolete. Gearless motors, in which the armature is built on the car axle, have been introduced, but single reduction motors having the armature shaft geared directly to the car axle are the most commonly used at present. Almost all modern car motors are of the multipolar type instead of the bipolar, as formerly, and the reduction in armature speeds is due to this change of design. The severe service to which street-car motors are subject has led to making them very substantial in design, in order to avoid mechanical injury, and so-called iron-clad motors, in which the field magnets form a closed iron box, are almost exclusively used to

prevent short-circuiting by water, or by nails or scraps of iron picked up by the magnets. Most of the single-reduction four-pole motors are supported on one side on the car axles by journals set in projecting lugs at each end of the motor frame, the armature shafts being parallel to the car axles. The opposite sides of the motors are connected to the frame of the car truck by means of springs, and a pinion on each armature shaft meshes with a gear wheel on either axle. The function of the springs is to avoid a shock on starting the car, by permitting the motors to turn through a small arc about the axles. In gearless motors the armature shaft is a hollow tube, through which the car axle passes, and to which it is flexibly connected by means of springs. A number of attempts have been made from time to time to connect the armature shaft and the axle by belts, sprocket chains, friction clutches, etc., none of which has been able to stand the service. The latest improvement in street-car motors is the development of the alternating-current single-phase motor. See DYNAMO-ELECTRIC MACHINERY.

**Controlling Systems.** The starting and regulation of speed of a single car are effected by means of the controlling switches on the car platforms. The methods of regulation of the different electric-railway systems are too numerous to be described in detail, but the same general plan is common to them all. With the direct-current system series motors are always used, and the field windings are wound in a number of separate sections, the ends of which are carried to contact pieces in the controlling switches. In addition to the resistance of the field winding a resistance box is also used. The contact pieces in the controller press against corresponding rows of metal plates, each row having its plate connected so as to vary the connections of the wires from the motor. In starting the car the resistance box, sections of the field coils, and armature are all in series to prevent a too large passage of current through the armature. The next turn of the switch cuts out more or less of the resistance-box circuit, allowing more current to pass, and by successive movements of the switch the field coils pass through various combinations, from all in series to all in multiple, the latter leading to the highest car speed. To stop the car the switch is reversed, making the same combinations in reverse order. To change the direction of the car, a separate switch is generally provided, which changes the direction of the current through the armature with reference to its direction through the fields. Where there is no commutation of the field coils, the changes in speed depend entirely upon the variable amounts of extra resistance thrown into the circuit.

**Multiple Unit Control.** In operating trains of several cars at high speed, and yet making many stops, as on the elevated roads in New York and Chicago and various underground lines, at least every other car of the train is equipped with motors, and the several motor-car equipments are operated simultaneously. This is accomplished by the so-called multiple-unit system of control, invented by F. J. Sprague. There are a number of systems of this sort in use, but all embody the same general principles. On each motor car is a group of switches and resistance grids which control the current flowing to the motors on that car.

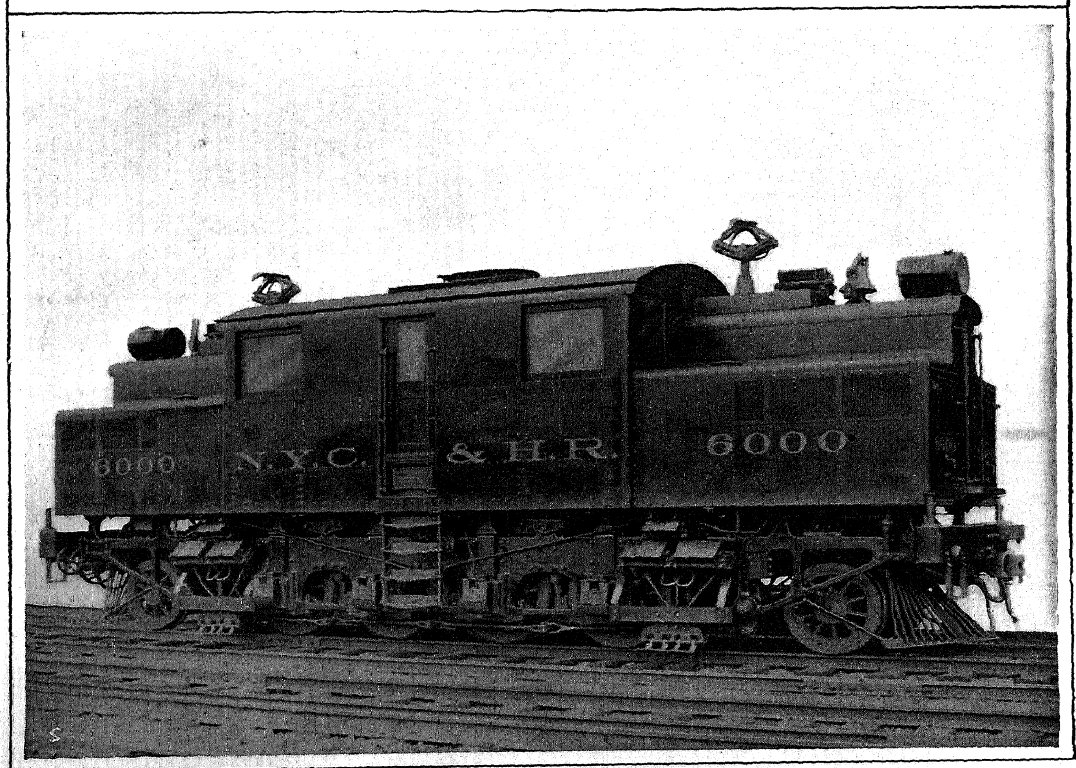
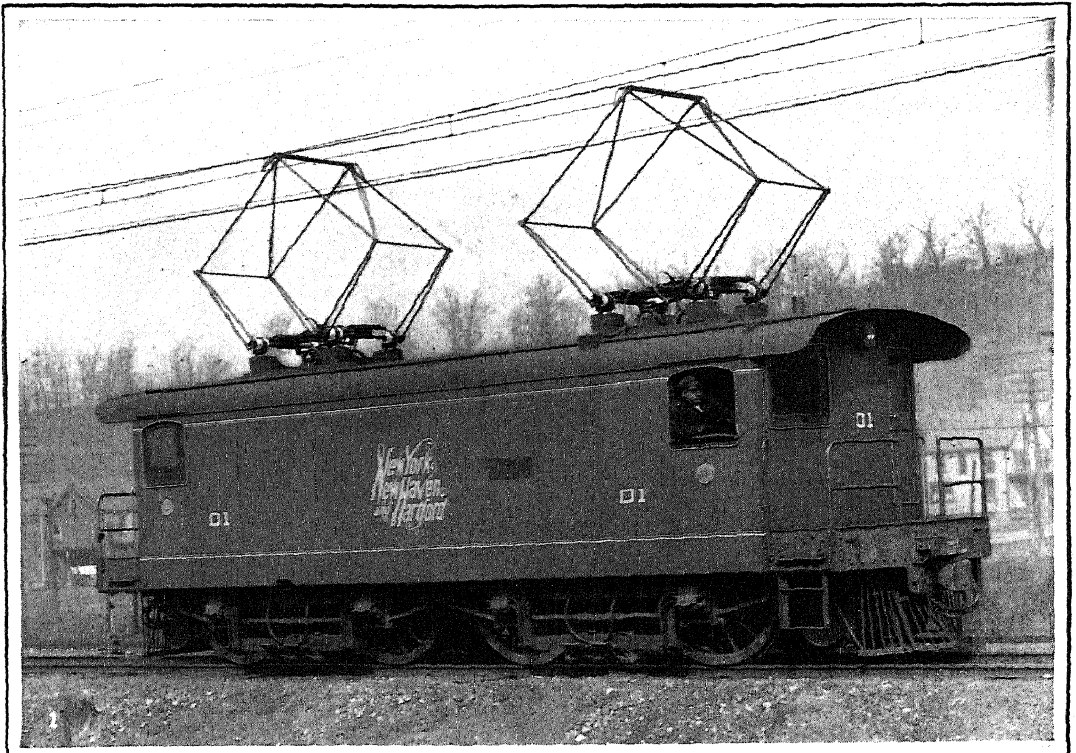
This controller is operated from a distance by means of pneumatic or electropneumatic devices controlled by circuits called pilot circuits, which circuits are connected to a master controller operated by the motorman. All the pilot circuits on all the cars are connected to form a "train line"; cars not equipped with motors must nevertheless be equipped with this line and the necessary cable couplers, so as to complete the line throughout the entire length of the train. This train line is connected to all motor controllers or contactors on the train, and to a master controller on each car, so that all the motors on the train can be operated from any car.

**Electric Locomotives.** An electric locomotive is a much simpler structure than a steam locomotive and can usually be designed to develop much greater power for the same weight. In many respects both have the same limitations in that the maximum tractive effort or drawing power is fixed by the adhesion of the rims of the driving wheels to the track. Electric locomotives differ in type according to the method of power supply and type of motor used (as described in preceding paragraphs), according to the method of supporting the motors, and according to the mechanical power transmission from the motors to the driving wheels. There are three common methods of motor support. The simplest is that in which the motor armatures are keyed directly to the driving axles and are permitted vertical play by the use of flat pole faces. In a second method the armature is supported on a quill or hollow shaft surrounding the axle, to which the turning effort is communicated by helical springs. In the third method the motors are carried on the side frames of the locomotive and are therefore not limited in size by the small space available on the trucks under the floor. When the motors are frame-mounted, the mechanical transmission of power may be through gears or by a system of cranks and rods resembling somewhat those used on steam locomotives.

The 1913 type of locomotive used on the New York Central system is 57 feet long and weighs 110 tons, all of which is carried by driving axles. There are eight motors, each of 325 horse power, with their armatures mounted directly on the axles. There are eight driving axles, grouped in four trucks. The two end trucks are of the bogie type and act as guides. The two middle trucks are articulated or hinged together so as to turn freely within certain limits, yet give great stability. The power supply is by direct current at 650 volts, obtained from a third-rail system. All the accessories of a steam locomotive are provided, viz., air compressors for brakes, whistle, bell, and track-sanding device. A small boiler is provided to furnish heat to the train. This locomotive is capable of hauling a train of 1200 tons at a speed of 60 miles per hour on a straight level track.

The locomotives of the New York, New Haven, and Hartford system are excellent examples of the single-phase type. The earlier locomotives consisted of a twin unit, each with four motors of 250 horse power with their armatures on quills surrounding the driving axles. The later locomotives are of single-unit construction and have eight motors mounted in pairs on the side frames of the locomotive. Each motor is of

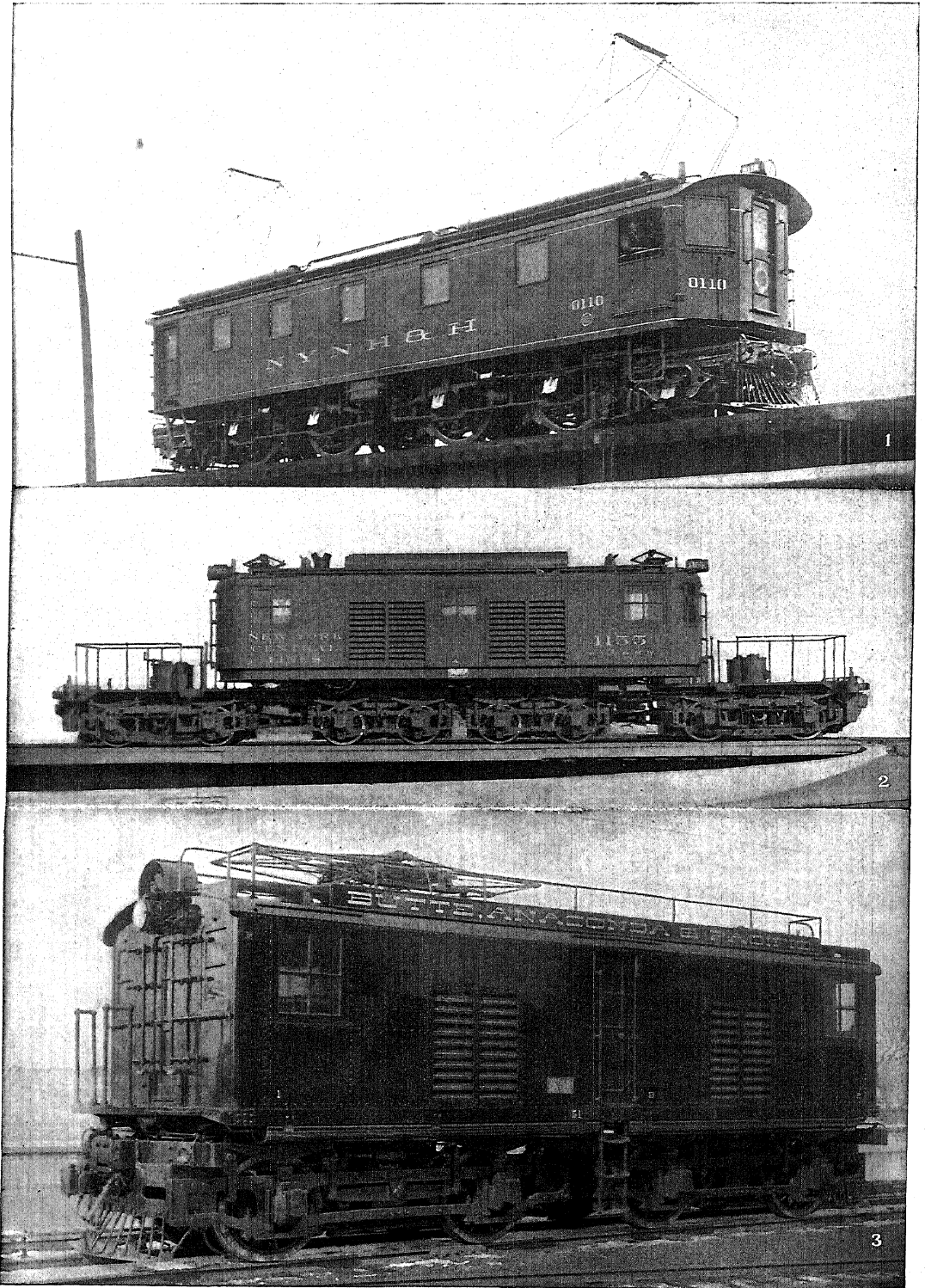
## ELECTRIC LOCOMOTIVES



1. NEW YORK, NEW HAVEN AND HARTFORD PASSENGER LOCOMOTIVE. BUILT BY WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.
2. NINETY-FIVE TON NEW YORK CENTRAL R. R. LOCOMOTIVE. BUILT BY GENERAL ELECTRIC COMPANY.



## ELECTRIC LOCOMOTIVES



1. WESTINGHOUSE SINGLE-PHASE ALTERNATING CURRENT HIGH SPEED PASSENGER LOCOMOTIVE, NEW YORK, NEW HAVEN AND HARTFORD RAILROAD.
2. GENERAL ELECTRIC COMPANY 600-VOLT DIRECT CURRENT ARTICULATED LOCOMOTIVE FOR NEW YORK CENTRAL AND HUDSON RIVER RAILROAD.
3. GENERAL ELECTRIC COMPANY 2400-VOLT DIRECT CURRENT ELECTRIC LOCOMOTIVE, BUTTE, ANACONDA AND PACIFIC RAILWAY.



170 horse power. Each pair of motors has its two pinions meshed with a common gear wheel which is carried by a quill . . . a driving axle. The flanges on the . . . quills are connected to the driving wheels by helical springs.

The large direct-current locomotives used in the New York terminal system of the Pennsylvania Railroad afford an excellent example of the type of construction . . . frame-mounted motors and side-rod . . . to the drivers. Each locomotive is a twin unit with a total weight of 166 tons. Each section of the locomotive has a 2000-horse-power motor driving four 68-inch wheels. Power is obtained from a third-rail system at 650 volts.

Since the early days of electric locomotives much attention has been given to the development of self-contained motor cars, but their use did not become extensive prior to 1907, when the present gasoline-electric type was developed. In its present form the motor car carries a six-cylinder gasoline engine of from 50 to 100 horse power which drives a direct-current electric generator at constant speed. The output of the generator is supplied to series motors mounted on the trucks. Cars of this type are independent of power stations and transmission systems. Their operating cost is much below that of a steam train for light service, and they can be operated with profit in many cases where steam service entailed a constant loss. See RAILWAYS.

**Central-Station Equipment.** A railroad power station is usually located as near as practicable to the centre of the system to gain economy in power transmission. Small city systems are generally supplied by direct-current generators. The more extensive systems employ polyphase alternating-current generating plants in conjunction with converting substations for local direct-current distribution. Many large railway systems make it a practice to purchase their power supply from central-station companies at wholesale rates, but maintain their own substations for the conversion of alternating to direct current. The size of the power station required by a railroad system depends on the number and weight of the cars to be operated and the grades to be surmounted. When the road operates 10 cars or less, it is customary to provide about 40 horse power of capacity per car. In the larger systems the heaviest demands of different cars and of different sections of track do not coincide, and a capacity of 20 horse power per car suffices. The power-station capacity required for main-line railroads and terminals is carefully predetermined by an elaborate study of train movements to determine the power requirements of each train and of the entire system from moment to moment.

**Important Electrifications.** The most important electrified main lines in the United States are the New York, New Haven, and Hartford Railroad (New York to New Haven, Conn.), the New York, Westchester, and Boston Railroad, and the Hoosac Tunnel of the Boston and Maine Railroad, all using the single-phase alternating-current system; the Grand Central terminal system of the New York Central Railroad, the New York terminal system of the Pennsylvania Railroad, the Baltimore tunnel of the Baltimore and Ohio Railroad, and the Detroit River tunnel of the Michigan Central Railroad,

all using third-rail direct-current systems at voltages below 750; the Cascade tunnel of the Great Northern Railroad, using the three-phase alternating-current system; and the Butte, Anaconda and Pacific Railroad, using the 2400-volt, direct-current system. The most important main-line electrifications in Europe are operated by the single-phase alternating-current system.

**Economics of Electrification of Steam Roads.** It was not until 1913 that a steam railroad was electrified purely for reasons of economy. The reasons which have been compelling in the electrification of steam railroads both in the United States and in Europe have generally been the desire to eliminate smoke and noise in terminals, to add to the pleasure and comfort of suburban travel, to permit of more frequent suburban service, to comply with city ordinances, or to add to the safety and comfort of the operation of trains through tunnels. While electrical engineers have demonstrated on paper that operation by electricity either third rail or overhead trolley is more economical than operation by steam, actual practice had not, up to 1914, borne out this contention. The economies which electrical operation should effect are a reduction in the wage account, a reduction in the fuel cost, an elimination of the cost of maintaining fuel and water stations, an elimination of the cost of water supply, and a reduction in the cost of repairs per unit of equipment.

To offset these economies there is the added cost of the interest charges on the electrification expenditures and the added cost of the maintenance of the third-rail or trolley system, together with certain added costs of the maintenance of other property due to the action of the electric current.

The economies have never been fully realized in practice, either in the United States or Europe, because up to 1914 no steam road had been so completely changed over from the former method of operation as to permit of the entire abandonment of water stations, etc., and of steam locomotives. Furthermore, the general experience of railroad managers has been that it has not been possible to cut down the labor cost. The pressure which the brotherhoods of locomotive enginemen and firemen have been able to bring to bear on the management has been such that they have had to maintain the same scale of wages for enginemen and the second men on electric locomotives as was paid on steam locomotives. The management of the New York, New Haven, and Hartford, which has had the most extensive experience among American railroads with electrical operation, is of the opinion that, if they can entirely eliminate operation by steam locomotives for both freight and passenger service between New Haven and New York City, their cost of operation will be lower with electricity than it would have been if steam operation had been continued and used exclusively.

Electrical engineers have contended that it was especially in operation of trains over heavy grades that electrical operation could effect the greatest economies. In the latter part of 1913, however, a very careful study of the possibilities of saving by the electrification of the Atchison, Topeka, and Santa Fe's line over the continental divide at Raton Mountain, N. Mex., was made, and the conclusion arrived at was that electrical operation would probably be more expensive,

when the interest charges on the installation were taken into account, than in steam operation. In this study it was estimated that the cost of the electrification of the 30 miles of line would be about \$2,000,000, and that the saving in annual cost of operation would be about \$60,000, or in the neighborhood of 3 per cent on the investment.

**The Economics of Electric-Railway Operation.** The various types of electric railways, the construction and operation of which have been described, may be classified, as to use, as street railways, interurban railways, either operating on the public highways or on a private right of way, and so-called electrified steam railroads.

[illegible]

Short-haul traffic is, of course, the most profitable business that street railways can do, and surface lines have a very much greater proportion of short-haul traffic than either elevated or subway lines. On the other hand, elevated lines and subway lines do not transfer, except in certain cases, and then usually only upon payment of something additional. The passenger journey, therefore, is necessarily continuous. It has been the experience of New York, Boston, and Chicago, that the transfer privileges required by city ordinances more than offset the apparently shorter average haul, so that, although the average haul is longer on the elevated or subway than on the surface lines, the elevated and the subway both showed more profitable operation than the surface lines. There are, of course, a great number of other

factors which enter into a comparison such as this—length of train, cost of maintenance, etc.—but it is generally conceded that the transfer privilege is far and away the most important factor.

The best unit of comparison of earnings and expenses of street railways exclusive of elevated and subway lines is the car mile. This, however, is open to many of the objections that the train mile as a unit in steam railroad operation is. It is not a real measure of work done. The cost per car mile may be somewhat increased by the use of larger and faster cars, while the number of passengers carried per car may be so increased by these changes as to more than offset the increase in expenses.

The common American practice in regard to subways is to have the city lend its credit, at least in part, to the construction company which builds these subways and to take a first lien on earnings to see that the interest charges which the city has guaranteed are paid; to lease the subways to an operating company for a term of years under such terms as will permit, presumably, of the operating company's paying off its funded indebtedness during the period of the lease and the reversion to the city of the subway at the end of the period of lease, with some provision for the purchase of the equipment in use at the expiration of the lease.

The above discussion, of course, applies only to the street railways of the large cities. The street railways of the smaller cities and towns are, in a very great number of cases, under the management of holding companies which also control gas and electric-lighting plants. Holding companies for these holding companies have in many instances been formed which control and direct the management of public-utility corporations in a number of widely separated towns and cities. It is quite impossible, therefore, to gauge accurately the earning capacity of street railways in the smaller towns and cities, because the results of their operation are combined with the figures showing the result of the operation of gas plants and of electric-lighting plants and also, of course, in many instances, of interurban railways.

In the United States the very rapid development of public utilities in the decade 1903-13 called for the investment of a vast amount of capital, which in these enterprises commanded a higher rate of interest than it could have got if invested in steam railroads or municipal or other government securities. In the great majority of cases local capital was raised for the original construction of a part, at least, of the public-utilities plants. Liberal franchises were, of course, granted, and there was in some instances competition, as, e.g., between two or more different street railways or between a gas company and an electric-lighting plant. The competition led to the desire for consolidation and construction profits; the possibility of increased earnings led to the desire for further extension and therefore to the invitation of outside capital. The enterprises being speculative in character, bankers who furnished this capital and effected consolidations took liberal commissions, and the securities were sold to investors to yield, for bonds about 5½ to 6 per cent, for preferred stock about 7 per cent, and for common stock usually the hope of large profits through the increase of market value of the stock.

Public utilities of this kind are natural monopolies, but, on the other hand, the earnings of street-railway companies are limited by the impossibility of charging, at least in the United States, more than a five-cent fare, regardless of the length of the ride; thus, the Interborough Rapid Transit charges but five cents from Flatbush Avenue, Brooklyn, to Van Cortlandt Park, at 242d Street, a distance of about 14 miles. To earn the returns on the investment which are necessary to induce new capital to come into enterprises of a somewhat speculative nature, strict economies of operation have been necessary as well as the rapid growth of population. See PUBLIC UTILITIES, REGULATION OF.

**Interurban Electric Railways** in some instances have afforded transportation service to territories wholly without facilities before, but in the overwhelming majority of cases the transportation facilities afforded by electric interurban railways have been in addition to the facilities already furnished by steam railroads. The reason for this, of course, is obvious. A steam railroad carrying freight can be built through very long stretches of territory in which there is a sparse population, since it can depend for the bulk of its earnings on its through-freight business. Electric roads are dependent almost entirely on local business, since they cannot compete in cost of service for through business over long distances with steam railroads, even where the steam road has the more circuitous route. The electric road must be built where the population is already fairly thick, and population has developed along the lines of the steam roads. With frequent and cheaper service the electric can compete quite successfully for passenger business with a steam road up to about 25 miles. For a longer haul than this the greater speed of the steam road apparently outweighs the consideration of frequency of service and of lower cost per mile with the great majority of travelers. It was at first believed that electric express service could compete with steam roads between large cities not more than 100 miles apart, but the majority of such electric roads have not been particularly successful. A good instance of this is the Chicago and Milwaukee, which was built at considerable expense with the idea of doing both freight and passenger business, but which went into the hands of a receiver in 1910 and in 1914 was not yet operating at a profit sufficient to pay the interest ordinarily demanded by investors in electric-railway securities on the original cost of its construction.

The influence of electric railways on steam roads which are paralleled is interesting. At first there is a very large falling off of passenger rates on steam roads. The added transportation facilities, however, not only induce more traveling, but add to the attractiveness of residence in the country served by these roads. This induces additional settlement, and after a few years the steam road makes up in long-haul passenger business a part of its loss in local business and in addition gets an inbound and outbound merchandise freight business that in part compensates it for the local passenger business taken away by the electric.

Passenger rates on interurban electric railways vary from three-fourths of a cent to a cent and a half per mile. This compares with two cents to three cents, the prevailing passenger rates on steam roads. Louis Fischer, in

his book on the *Economics of Interurban Railways*, claims that the approximate average earnings of an interurban railway operating from one large town out through a town and village population is about \$10 per capita of intermediate town and village population, regardless of the size, within certain limits, of the primary city terminal. Where the road runs between two large cities, the earnings, in the neighborhood of \$10 per capita of intermediate population, will be . . . by from \$6 to \$20 per capita of . . . of the secondary terminal where this secondary terminal is 40 miles or less away from the primary terminal.

Bibliography: Parshall and Hobart, *Electric Engineering* (New York, 1907); Dawson, *Electric Traction on Railways* (London, 1909); Burch, *Electric Traction for Railway Trains* (New York, 1911); Harding, *Electric Railway Engineering* (ib., 1911); Sheldon, *Electric Railway and Transmission Engineering* (ib., 1912); Kirkman, *Electricity Applied to Railways* (Chicago, 1912); *Standard Handbook for Electrical Engineers* (New York, 1912); *American Handbook for Electrical Engineers*, ed. by Pender (New York, 1914); numerous articles in the *Electric Railway Journal* (ib., weekly) and the *Railway Age Gazette* (ib., weekly).

**ELECTRIC RAY.** See ELECTRIC FISH; TORPEDO.

**ELECTRIC TELEGRAPH.** See TELEGRAPH.

**ELECTRIC WAVES.** See ELECTRICITY.

**ELECTRIC WELDING.** See WELDING.

**ELECTRIDES**, ê-lêk'tri-dêz (Lat., from Gk. ἤλεκτρίδες, *Elektrides*, from ἤλεκτρον, *ēlektron*, amber). The Amber Islands of Greek mythology, situated at the mouth of the Eridanus, a large river which was identified with the Po, because amber was found at the mouth of the latter. The name was applied also to islands on the northern coast of Europe. See AMBER.

**ELECTROBALLISTIC MACHINES.** See BALLISTICS.

**ELECTROBALLISTICS.** The science of measuring the velocity of projectiles by means of electrical instruments. Velocity may be measured, both inside and outside the bore of the gun, at predetermined points in the path of the projectile. The makes and breaks of electric circuits at these points are recorded, as a function of time, by the instrument. See BALLISTICS.

**ELECTROCHEMISTRY, GENERAL.** The branch of general chemistry that deals with chemical changes producing, or caused by, electrical energy. The growing industrial applications of electrochemistry are making the science itself more and more important every year. Another title of electrochemistry to general interest consists in the fact that the phenomena it deals with have long formed a bond between two great branches of human knowledge—physics and chemistry—the science of the various forms of energy and the science of the various kinds of matter.

The bond may become even more intimate if the comparatively recent hypothesis, according to which electricity itself is a subtle form of matter, turns out to be in agreement with facts. This hypothesis is briefly as follows: Electricity consists of two chemical elements whose atoms, termed "electrons," have exceedingly small (perhaps zero) relative weights; the atoms of positive electricity, or "positive electrons," may be denoted by the symbol  $\oplus$ ; the

atoms of negative electricity, or "negative electrons," may be denoted by the symbol  $\ominus$ . Like the atoms of hydrogen, electrons of either kind are univalent, so that, e.g., an atom of hydrogen when in the ionic state (i.e., when charged with electricity) is combined with a single positive electron, forming the molecule  $\text{H} \oplus$ , while an atom of oxygen in that state forms the molecule  $\text{O} \ominus$  (just as water is  $\text{HOH}$ ). When not thus combined with the atoms of other elements, electrons may possibly form neutral molecules  $\oplus\ominus$ . The substance made up of such molecules may have appreciably no weight, may be a nonconductor, and may be capable of electric polarization; and it is worthy of note that these are precisely the properties attributed to the luminiferous ether. While this hypothesis renders Faraday's law (see ELECTRICITY) a special case of Dalton's law of multiple proportions and may certainly be helpful in fixing on the mind a somewhat definite image of the mechanism of electrical processes, it can hardly be said yet to rest on a sufficient foundation. Whether it should be accepted or not will have to be decided on the principle expressed, some years ago, by Poincaré: "It is nonsense to ask of a theory, 'Is it true or false?' The question can only be, 'Is it fruitful or not?'"

At any rate, the electron hypothesis must not be allowed to confuse our conception of *electrical energy* and its relations to other forms of energy. The term "energy," when properly used, designates the cause of any change that is actually taking place, or that is capable of taking place, in a given system. Thus, we may speak of the energy of a falling body, and even of a body suspended at a certain height from the earth's surface; for such a body, if released, *would* fall to the earth. Similarly, we may speak of "electrical energy" whenever a transport of electricity from one point to another is possible in a given system. Energy of every known form can be resolved into two factors—a "capacity factor" and an "intensity factor." In the case of electrical energy the capacity factor is generally known as "quantity of electricity," the intensity factor as "potential difference." Just as in the case of a suspended body the amount of gravitation energy is the greater, the greater the mass of the body and the greater the difference of level between the body and the earth's surface, so in the case of a possible flow of electricity the amount of electrical energy is the greater, the greater the quantity of electricity and the greater the difference of potential between the two given points. Whatever be the ultimate nature of a mass of matter, gravitation energy is still a form of energy. Similarly, whatever be the ultimate nature of a quantity of electricity—whether electricity be a kind of matter or not—electrical energy is still a form of energy, capable of being transformed into kinetic energy, chemical energy, etc.

**Electrochemical Reactions.** A system in which chemical energy is transformed into electrical is termed a galvanic or voltaic cell, and a combination of two or more cells is termed a galvanic or voltaic battery. One of the first questions that naturally suggest themselves to the student of electrochemistry is, What are the characteristics of those chemical changes whose energy may assume the electrical form? In other words, What chemical reactions can

be utilized for the construction of voltaic cells? The answer is, *All changes, and only such changes, in which acids, bases, or salts take part, or may be caused to take part, can be employed electrochemically.* Substances of these classes are termed "electrolytes," and they are usually employed, in cells, in the form of aqueous solutions, in which their molecules are assumed to be dissociated into fragments, termed "ions" (see DISSOCIATION), that are charged with either positive or negative electricity. In most cells the chemical action consists, on the one hand, in the solution of one of the metallic electrodes, its particles entering the solution in the form of ions, and, on the other hand, in the deposition upon the other electrode of another metal, whose particles formed the ions of the solution. For example, the Daniell cell consists, on the one hand, of a zinc electrode immersed in a solution of zinc sulphate, and, on the other hand, of a copper electrode immersed in a solution of copper sulphate, the two solutions being in contact, and the two metals being connected by a metal wire; the chemical action of the cell consists, on the one hand, in the entrance of zinc into the solutions in the form of zinc ions, and, on the other hand, in the deposition, on the copper electrode, of copper ions in the state of metallic copper. The two simultaneous changes evidently ensue in the system at two separate points connected with each other by a suitable conductor of electricity. This "chemical action at a distance" is an essential characteristic of electrochemical action.

An excellent example of common changes in which electrolytes may be caused to take part, and which may thus be turned into a source of electric energy, is presented by the mere flow of hydrogen or oxygen gas, at constant temperature, from places of higher to places of lower pressure. If, say, hydrogen gas is contained in two separate vessels under unequal pressures, a flow of gas will naturally take place from one vessel into the other if communication is established between them. But the equalization of pressures can also be caused to take place as follows: Let two bars of platinum coated with "platinum black" (finely divided platinum, which has a great capacity for taking up gases) be half immersed in a solution of sulphuric acid, while the other halves are exposed to hydrogen gas contained in two vessels, under two different pressures; on connecting the platinum bars outside the solution by a metal wire, it will be found that a current of electricity passes through the latter, while hydrogen passes through the solution until the pressures in the two vessels have been equalized. The action thus taking place is as follows: in dilute aqueous solution the molecules of sulphuric acid are broken up into electropositive hydrogen ions  $\text{H}$  and electronegative ions  $\text{SO}_4$ ; neutral hydrogen molecules from the vessel of greater pressure enter the solution in the form of hydrogen ions and, replacing the free hydrogen ions of the acid, drive them from the solution in the form of neutral molecules into the vessel of lower pressure. Evidently here, too, as in the case of any other voltaic cell, the electric current is caused by ions taking part in the change.

**Electromotive Force.** We can now discuss the question as to what determines the electromotive force of a voltaic cell, i.e., the difference

of potential existing between its two electrodes. It was once believed that a considerable difference of potential is established whenever two different metals are placed in contact with each other; but this is now positively known to be wrong. If differences of potential arise from the communication of the electrodes outside the solution, those differences are certainly very small and need not be taken into account. In the case of cells with two different solutions (like the Daniell cell), a difference of potential is known to exist at the surface of contact of the two solutions; but this, too, is comparatively small. The main difference of potential in a cell must therefore be seated at the surfaces of contact between the metallic electrodes and the electrolyte solutions, i.e., at the places where ions form and disappear. But how are differences of potential established there? A clear answer to this question is furnished by modern electrochemical theory. If a liquid is placed in a closed vessel, its vapor gradually attains a maximum pressure which balances the vapor tension of the liquid at the given temperature. Again, if an excess of sugar is placed in some water, the sugar dissolves, or, so to speak, vaporizes into the water, and the portion dissolved gradually attains a maximum "osmotic pressure" which balances the "solution tension" of sugar at the given temperature. Similarly, if a metal is brought in contact with water, its ultimate particles tend to rush into the volume of the water until a maximum osmotic pressure has been attained. Since, according to the theory of electrolytic dissociation, the free particles of a metal in solution are invariably charged with positive electricity, the osmotic pressure of a metal in solution can evidently be exerted only by its electropositive ions. Supposing, now, that a bar of some metal is placed in a solution of *one of its salts*, and remembering that the salt is dissociated into metallic and acidic ions, we readily distinguish three possible cases; viz., the osmotic pressure of the metallic ions may happen to be greater than, less than, or equal to, the maximum osmotic pressure that would balance the "electrolytic solution tension" of the metal.

In the first of these cases some ions will tend to precipitate themselves upon the metal bar, just as some of the vapor of a liquid would tend to condense if its pressure exceeded the vapor tension of the liquid; and the force driving the ions out of solution will evidently be the excess of their osmotic pressure over the solution tension of the metal. As soon, however, as a single ion is precipitated out, the metal bar is rendered electropositive, while the solution is rendered electronegative by the newly created excess of electronegative ions; for before the immersion of the metal bar the electropositive and electronegative ions in solution are precisely equivalent. (See DISSOCIATION.) But this means that a difference of potential will have been created between the metal bar and the solution. Henceforward every electropositive ion driven towards the metal bar by the excessive osmotic pressure will encounter a double force driving it back into solution, viz., the electrostatic repulsion of the positive bar and the electrostatic attraction of the negative solution. Finally, when a certain number of ions have been precipitated out, the double electrostatic counterforce will have become equal to the excess of osmotic pressure,

and then, equilibrium ensuing, the maximum difference of potential possible under the given conditions will have been established between the metal bar and the solution. This will obviously be the greater, the greater the osmotic pressure (i.e., the concentration of ions in the solution), and the less the specific solution tension of the metal.

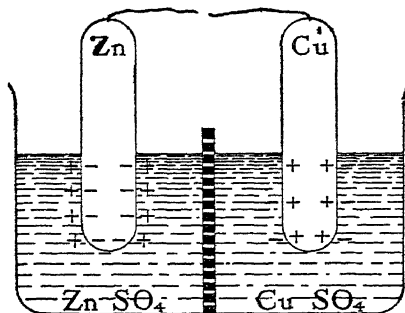
Passing now to the second of three possible cases, viz., the case in which the osmotic pressure of the metallic ions is less than the specific solution tension of the metal, we see that in this case molecules of the metal will enter the solution in the form of positive ions, rendering the solution electropositive and leaving the metal bar electronegative. In this case, too, an electrostatic counterforce will then come into play, and the difference of potential at the surface of contact will be maximum when this force has become equal to the difference between the solution tension of the metal and the osmotic pressure of ions in the solution. The difference of potential will obviously be the greater, the greater the solution tension of the metal and the less the osmotic pressure of its ions in the solution.

Finally, in the third case, viz., the case in which the osmotic pressure of the metallic ions exactly equals the solution tension of the metal, neither metal will dissolve nor ions precipitate, and consequently no difference of potential will exist at the surface of contact of the metal and the solution.

It may be objected that hypothetical views of this type may and may not be true, and this correctness cannot be expected to be amenable to experimental test. But Palmaer has succeeded in producing, to say the least, strong experimental evidence in their favor. Mercury, viz., is one of those metals whose electrolytic solution tension is very slight, and even in contact with a weak solution of one of its salts it becomes positively charged, mercury ions precipitating themselves upon the metal from the solution. Palmaer placed some metallic mercury in a vessel and covered it with a fairly tall layer of a weak solution of mercury salt. Into this he allowed to run from above a steady stream of droplets of mercury from a dropping funnel. Each droplet took up mercury ions in the upper part of the solution and carried them along, but had to give them up to the lower part of the solution when it joined the body of metallic mercury at the bottom of the vessel, for this body soon became *electropositive* with positive electricity. The lower part of the solution thus becoming positively charged, while the upper part became negatively charged (owing to loss of positive mercury ions), negative ions migrated from the upper part downward, and in this manner a real transportation of the mercury salt as a whole took place. Palmaer was able to show, by actual analysis of different layers of the solution, that the lower layers had become appreciably more concentrated than the upper ones, as was to be expected if the principles developed above were true.

Our principles permit of gaining a clear insight into the mechanism of electrochemical action. Take, e.g., again the Daniell cell, which consists, as we have seen, of a concentrated solution of zinc sulphate and a concentrated solution of copper sulphate, separated from each other by a porous partition, with a bar of metallic zinc in the former solution and a bar of

metallic copper in the latter (see Fig.). It will be seen in a later section of this article that the solution tension of zinc is very great, that of copper very small. Some zinc will therefore enter the solution in the state of positive ions,



DANIELL CELL.

which will render the zinc solution electro-positive and leave the zinc bar electronegative. On the other hand, a number of copper ions will join the copper bar in the state of metallic copper, rendering the bar electropositive and leaving the copper sulphate solution electronegative. Equilibrium will ensue when the excess of solution tension in the case of zinc and the excess of osmotic pressure in the case of copper are exactly counterbalanced by the electrostatic forces as explained above. Now, if we should then connect the two bars by means of a metal wire, a flow of electricity (positive electricity from copper to zinc, negative from zinc to copper) would take place between the two bars, and thus the equilibrium would be destroyed. Freed from the electrostatic attraction, the excessive zinc ions of the zinc sulphate solution would migrate towards the excessive negative ions of the copper sulphate solution. At the same time more zinc, driven by the unchecked solution tension, would go into solution, and more copper ions, driven by the unchecked osmotic pressure, would be precipitated upon the copper bar. If we should break the connection between the bars, the former equilibrium would soon be re-established, and chemical action would cease. But as long as the connection exists, zinc goes into solution, copper is precipitated, and a current of electricity passes through the connecting wire; we say, "electrochemical action is going on."

Suppose, now, that the copper sulphate solution of the Daniell cell were replaced by a solution which could take up molecules from the copper bar, but in which those molecules, instead of being transformed into ions, would form a practically undissociated compound with some other ingredient present. The osmotic pressure of copper ions would thus be extremely slight and might be exceeded by the electrolytic solution tension of copper, in spite of the latter being comparatively small. It is therefore easy to see that under certain conditions it might be possible to reverse the electrochemical process of the cell. As a matter of fact, this is precisely what happens when the copper bar of a Daniell cell is immersed into a concentrated solution of the cyanide of potassium. On closing the circuit copper then goes into solution, zinc is precipitated, and the direction of the current is reversed. This and similar phenomena were formerly described as "anomalous," because they seemed

to contradict the assumption that zinc has a greater "affinity" for acids than copper. Substituting the definite concept "solution tension" for the vague concept "affinity," and adding the factor of the "osmotic pressure of ions," we experience no difficulty in understanding effects like the reversion of current in the Daniell cell by potassium cyanide and many other phenomena. And it must be observed that the osmotic pressure of ions is a measurable quantity (see SOLUTION; DISSOCIATION), and that the solution tension of metals, too, has now been calculated from directly measurable quantities. See further below.

Closely allied to the electrochemical action of voltaic cells is the immediate precipitation of one metal by another. The precipitation of copper by iron from solutions of copper salts, and the precipitation of finely divided ("molecular") silver by zinc, are familiar examples of this phenomenon, the cause of which is almost self-evident in the light of our theory. When a bar of iron, e.g., is immersed in a solution of copper sulphate, the solution tension of the iron causes the appearance of some iron ions, and hence the formation of an excess of positive over negative electricity in the solution; the electrostatic repulsion between the different metallic ions then tends to drive both iron ions and copper ions out of solution; but the solution tension of iron is very great, and so the iron ions remain in solution; on the other hand, the slight solution tension of copper is readily overcome by the force of electrostatic repulsion, and so copper ions are driven out and appear in the state of metallic copper. An analogous exchange takes place when a metal dissolves in an aqueous solution of some acid, the solution tension of hydrogen being overcome by the electrostatic repulsion between the ions of hydrogen and those of the metal. Only here the external pressure of hydrogen gas comes into play; for the electrolytic solution tension of a gas depends upon its pressure, just as its ordinary solubility depends upon the pressure. We have seen above that a voltaic cell may be obtained by using a dilute acid and two quantities of hydrogen gas under different pressures; the two quantities of hydrogen act like two different metals because, owing to difference of pressure, their solution tensions are different. Further, it is easy to see that while for certain pressures of hydrogen the solution tension of a given metal may be greater, for other pressures of hydrogen the solution tension of the metal may, on the contrary, be less, than the solution tension of hydrogen. In other words, if we should place in a vessel filled with hydrogen under sufficient pressure the solution of some metallic salt, the metal might be precipitated out by the hydrogen. As a matter of fact, this curious phenomenon has been observed in the case of several metals. If in a vessel containing hydrogen under a pressure of 18 atmospheres (270 pounds per square inch) metallic zinc is brought into contact with a solution containing per liter 12¾ grams of sulphuric acid and 210 grams of zinc sulphate, no action takes place. If the pressure is slightly diminished, zinc goes into solution, and hydrogen is evolved. In recent years, as set forth in a series of papers published in the *Berichte der deutschen chemischen Gesellschaft*, Ipatieff has investigated this phenomenon in the case of copper and nickel solutions and has succeeded in precipitating copper e.g. in the metallic state



by placing the solution in an atmosphere of highly compressed hydrogen. That the concentration of gas (i.e., the amount compressed in a given volume) plays the determining rôle in this phenomenon is clearly evident; and so this and similar phenomena, too, go to show the inadequacy of older chemical theory, which is "qualitative" (in a vague qualitative way) only the "affinity" factor, and leaving out of account the factor of concentration, "explains" the dissolution of metals in acids by the assumption that metals have greater affinity for acid radicles than hydrogen.

**Electrochemical Series.** The potential differences established between metals and their salts are now known for a number of different metals. A detailed explanation of the principles on which they are determined would carry us somewhat beyond the scope of this article. Suffice it therefore to state that the starting point is a determination, by an ingenious method, of the potential difference between metallic mercury and solutions of salts, and that the potential difference between mercury and a normal aqueous solution of one of its salts has thus been shown to be 0.99 volt, the metal being electropositive with regard to the solution. This fact known, there is no difficulty in determining the potential difference for any other metal and its solutions. Indeed, let the problem be to determine the potential difference established when metallic zinc is placed in a normal solution of zinc sulphate. To do this, we may construct a cell consisting of a mercury electrode in a normal solution of mercuric sulphate and a zinc electrode in a normal solution of the sulphate of zinc, the two solutions separated by a porous partition and the two metals connected by a wire. By direct determination the electromotive force of this cell may be shown to be 1.514 volts; and as the potential difference between the mercury and its solution amounts to 0.99 volt, it is evident that the potential difference between zinc and the normal solution of its sulphate must be 0.524 volt. In this calculation the slight potential difference between the two solutions has been neglected. In calculating the following table, however, that difference, too, has been taken into account; and so the figure for zinc, 0.51, is somewhat more precise than our figure, 0.524. The table shows the potential differences between metals and their salt solutions of normal concentration, the plus sign showing that the solution is electropositive with regard to its metal, and the minus sign showing that the solution is electronegative with regard to its metal.

Magnesium ...	+ 1.22	Iron.....	+ 0.06	Copper ....	- 0.60
Zinc .....	+ 0.51	Nickel ....	- 0.02	Mercury ..	- 0.99
Aluminium ..	+ 0.22	Lead .....	- 0.10	Silver .....	- 1.01
Cadmium....	+ 0.19	Hydrogen ..	- 0.25		

The series is similar to part of the old electrochemical order of Berzelius. (See historical section under CHEMISTRY.) Only, again, while that order was purely qualitative, the modern series represents an exact qualitative expression of the electrical properties of metals and besides refers to a definite concentration of their solutions. Since the potential difference between a metal and a solution depends upon the solution tension of the metal and the osmotic pressure of its ions in the solution, and since both the potential difference and the osmotic pressure can be deter-

mined, it is evidently possible to find also the solution tensions. The following table shows the results of such calculations based on the table given above:

Magnesium....	10 <sup>14</sup>	Iron .....	10 <sup>8</sup>	Copper.....	10 <sup>-12</sup>
Zinc .....	10 <sup>13</sup>	Nickel.....	10 <sup>9</sup>	Mercury.....	10 <sup>-15</sup>
Aluminium ..	10 <sup>13</sup>	Lead .....	10 <sup>-2</sup>	Silver .....	10 <sup>-15</sup>
Cadmium .....	10 <sup>7</sup>	Hydrogen....	10 <sup>-4</sup>		

The figures represent the solution tensions in terms of atmospheres and may be changed to pounds per square inch by multiplying by 15. The solution tension of iron, e.g., equals a pressure of 15,000 pounds per square inch. The enormous tension of magnesium may serve to indicate how great may be the electrostatic counterforces long before the amount of metal in solution has become appreciable.

**Concentration Cells.** We have seen, in a previous section, that in the usual electrochemical cell the main seat of electromotive force is at the surfaces of contact of the metallic electrodes and the solution. There are, however, cells in which the electrodes may be of one and the same metal; if in such a cell the solution in contact with the two electrodes were also the same, the two electrodes would be *equally* charged, and there would obviously be no *difference* of potential between them; in other words, such a cell would possess no electromotive force at all. But since, as we have seen, the electrification of a metal depends on the concentration of the solution in contact with it, two electrodes made of one and the same metal may be differently electrified by placing them in contact with solutions of different concentration. This suggests the idea that a cell may be constructed by preparing two unequally strong solutions of one and the same electrolyte, placing them in compartments separated by a porous partition (of, say, unglazed porcelain), and immersing two bars of some metal in the two solutions. And, as a matter of fact, if the electrodes of such a cell are connected by a metal wire, a current of electricity is found to flow from one to the other. In such a cell the seat of potential difference is at the surface of contact of the two unequally strong solutions, and therefore such a cell is called a "concentration cell."

Nernst has shown how the electromotive force of a concentration cell may be predetermined theoretically. To take the simple case of an electrolyte made up of two ions, like hydrochloric acid or potassium chloride, the electromotive force, according to Nernst, is proportional to the logarithm of the ratio of the two concentrations employed (or, more precisely, the ratio of the *ionized portions* of the electrolyte in the two unequally strong solutions employed). Calling the concentration of the ionized electrolyte in the stronger solution  $\eta_1$  and the concentration of the ionized electrolyte in the weaker solution  $\eta_2$ , the electromotive force of the cell, no matter what metal is used to make the electrodes (as long as the two electrodes are identical), may be calculated by the formula:

$$E = C \cdot \log \frac{\eta_1}{\eta_2}$$

In this formula  $E$  denotes the electromotive force. The factor  $C$  may be calculated theoretically by multiplying  $T$  (the absolute temperature) by 0.0000861 (the so-called "gas constant")

in C. G. S. units for a quantity of substance carrying one C. G. S. unit of electricity), and further multiplying the product by the quantity  $\frac{u-v}{u+v}$ , where  $u$  and  $v$  are the conductances, i.e., the capacities for carrying electricity, of the two ions involved. Obviously, if the two conductances  $u$  and  $v$  should happen to be equal, we should have  $u-v=0$ ; therefore,  $C=0$ ; and therefore, according to the above formula,  $E=0$ . This shows that the electromotive force of a concentration cell is due to the ions being unequally mobile, and if in a given case the two ions of an electrolyte should happen to be capable of traveling (diffusing) with the same speed, then a difference of concentration in different parts of a solution will produce no electromotive force. Generally, for a given ratio of concentrations the electromotive force will be the greater, the greater the difference of the conductances of the two ions. As an example, the conductance of a hydrogen ion at 18° C. (291° on the absolute scale) is expressed by the number 318; the conductance of a chlorine ion by the number 65.9. If we should now fill a porous porcelain cell with  $\frac{1}{10}$ -normal hydrochloric acid, and place the cell in a beaker containing hydrochloric acid 10 times as strong ( $\frac{1}{10}$ -normal), then  $\eta_1/\eta_2=10$ , and, according to the above formula, we should get  $E=0.0379$ , a considerable electromotive force. If we should next employ potassium chloride instead of hydrochloric acid, the concentrations being the same as before, we should have to expect a *very small* electromotive force; for the conductance of the potassium ion (65.3) is nearly the same as that of the chlorine ion (65.9). As a matter of fact, the electromotive force of such a potassium chloride concentration cell is less than three ten-thousandths of a volt,—nearly 150 times less than the electromotive force of the corresponding hydrochloric acid cell. In connection with this subject it would be well to read also the article *DIFFUSION*.

**Electrolysis.** The electrochemical principles developed above, together with the theory of electrolytic dissociation (see *DISSOCIATION*), explain the mechanism of electrolysis without any difficulty. We have seen above that in a voltaic cell chemical changes are used to produce electrical energy; in electrolysis, on the contrary, an electric current from some outside source is passed through the given system and causes chemical changes to take place in it. The laws of electrolysis may be found stated in the article *ELECTRICITY*.

**Transformation of Energy.** The term "chemical affinity" is now often used, not only in connection with compounds, but also in connection with their transformations. It is a fundamental principle in modern exact science, that any change whatever that takes place in a given system without the supply of energy from without is capable of yielding mechanical work. Thus, a weight can be lifted by the expansion of a sufficiently compressed gas, and of course the greater the weight, the greater the work done. The greater the work done, the more the gas is cooled; for the work is done at the expense of the energy of the gas. If the same gas were allowed to expand the same amount in vacuo (i.e., without having to overcome any resistance), no work would be done, and therefore no fall of temperature would be observed; in other words, the total energy of the gas would remain un-

changed; yet its capacity for doing work would obviously be diminished owing to the diminution of pressure. Physicists therefore distinguish between the total energy of systems and their free energy, the latter representing that part of the total energy which can be transformed into mechanical work when the system undergoes a spontaneous change. Evidently the maximum work that can thus be obtained measures the free energy of the system; and as the free energy represents the "driving power" that causes the change, it is evident that we have obtained an exact measure of that cause when we have measured the maximum work that can be yielded by the change. In the case of chemical transformations it is that same "driving power" which is now often referred to as the "chemical affinity of reactions." In the case of voltaic cells the free chemical energy may be entirely transformed into electrical energy. If the cell is perfect, i.e., if it yields really the maximum of electrical energy that can be obtained from its chemical changes, then evidently the electrical energy measures the affinity of the chemical changes; for the electrical energy of a cell can be entirely transformed into mechanical work. Now, we have seen in the introductory section of this article that electrical energy is a product of two factors, quantity of electricity and potential difference. The quantity of electricity passing through a cell is proportional to the number of chemical equivalents of the ions entering or leaving the solution (Faraday's law), each chemical equivalent (in grams) carrying 96,540 coulombs of electricity. On the other hand, the total potential difference of a cell is measured by its electromotive force and can be readily determined by the use of some "standard" cell. It is therefore clear that the electrical energy of an electrochemical process can be readily ascertained, and that the chemical affinity of any reaction in which acids, bases, or salts can be caused to take part is proportional to, and hence is measured by, the electromotive force of a voltaic cell based on the reaction. It is further clear that, on the contrary, whenever the maximum mechanical work that can be yielded by a given transformation can be ascertained without the aid of an electric process, the electromotive force of a cell based on the transformation can be calculated beforehand.

One more important point claims attention before we dismiss the subject of the energy changes of voltaic cells. The chemical reactions of a cell can also take place without producing electrical energy. Thus, the reaction of a Daniell cell can be produced by simply immersing a bar of zinc into a solution of copper sulphate. In that case the change is accompanied by the evolution of a definite amount of heat. The question therefore arises, Can all that "heat of the reaction" be transformed into electrical energy or not? At one time this question was answered in the affirmative ("Thomson's law"). But Willard Gibbs and Helmholtz have proved thermodynamically, and it has since been demonstrated experimentally, that the electrical energy of a cell need not by any means equal the heat of the reaction; that, on the contrary, the latter is usually greater than the former, so that even in perfect cells (producing a maximum of electrical energy) a rise of temperature might generally be observed. In certain rarer cases, on the contrary, the electrical energy produced in a cell is, curiously enough, *greater* than the

total heat energy of the reaction. Not, of course, that the excess of electrical energy is created by the cell out of nothing, but in addition to the heat of the reaction, a certain amount of energy is abstracted from the surroundings, and, as a rule, the temperature of such a cell falls during action. As a rough approximation, however, "Thomson's law" is still useful for practical purposes. See THERMOCHEMISTRY.

**History.** The earliest electrochemical observation on record was made by Deimann and Paets van Troostwyk, of Haarlem, in 1789. The experiment was carried out as follows: A glass tube with one end closed and the other open, and with a metal wire sealed into the closed end, was filled with water and inverted over a dish of water; a second metal wire was passed through the open end of the tube, up to within some distance of the end of the upper wire; and electric sparks were caused to pass between the ends of the two wires. The result was that water was decomposed into its constituents, oxygen and hydrogen, a mixture of which collected in the upper part of the tube. As long as the end of the upper electrode remained immersed in water, nothing further happened; but the instant the end of the electrode became exposed to the mixture, a violent explosion took place, owing to the recombination of the two elements. In a similar manner Ritter afterward carried out the first true electrolysis, using silver wires as electrodes and a solution of a silver salt as the electrolyte. Then came Volta's celebrated experiments, which resulted in his invention of voltaic batteries (see VOLTAIC BATTERY); and in 1795 Volta was able to prepare the first electrochemical series. An appreciation of the work of Davy and Berzelius, and of the sway of Berzelius' ideas exercised for many years in the science of chemistry, may be found in the article CHEMISTRY (historical section). Faraday's discovery, in 1834, of the true laws of electrolysis marked a great step forward both in chemistry and in the science of electricity. The conception of energy, of its several forms, and of their mutual transformations, was developed in course of the fifth and sixth decades of the nineteenth century, and in 1847 Helmholtz first advanced the belief that the heat of the chemical reactions of a cell may be entirely transformed into electrical energy. Having been again brought forward by Thomson in 1851, the belief became known in science as "Thomson's law." The researches establishing the true relation were carried out by Gibbs in 1878 and by Helmholtz in 1882 and were completed by the experimental investigations of Czapski and Jahn. In 1886 Van't Hoff introduced the modern theory of osmotic pressure (see SOLUTION), and in 1887 Arrhenius advanced the theory of electrolytic dissociation (see DISSOCIATION), which is at the basis of the most important chapters of modern electrochemistry. The idea that electrolytes must be more or less broken up in their solutions originated with Clausius; but Arrhenius was the first to give it its present quantitative form, to connect it with the theory of solutions, and to demonstrate its great importance for theoretical chemistry. The researches of Hittorf on the relative rates of migration of the ions during electrolysis were carried out as early as 1853 to 1859, but gained great scientific importance only after Arrhenius established his theory of dissociation. Other important names connected

with the progress of general electrochemistry are those of Ostwald, Nernst, Planck, Le Blanc, and Kohlrausch, Nernst especially being well known for his theory of the cell, of which a partial sketch is given above under the side head *Concentration Cells*. The concept of electrons originated in Helmholtz's lectures on Faraday's ideas of electricity, delivered in London in 1881. Among those who have contributed to the recent development of this promising idea are Nernst, Abegg, and Bodländer.

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**ELECTROCHEMISTRY, INDUSTRIAL.** Electrochemical processes are now employed in extracting metals from their ores and in parting them from their alloys; in the deposition of certain of the finer metals upon the surfaces of baser metals and other materials; in the manufacture of various chemical products employed in the arts and for various miscellaneous purposes. The processes of *electrometallurgy*, by which metals are extracted from these ores or parted from these alloys, can be best considered in the articles describing those metals.

The electrodeposition of certain metals upon the surfaces of other substances is called *electroplating*. When electroplating is employed as a means of copying printing type, medals, seals, woodcuts, etc., it is called *electrotyping*. The metals commonly used for electroplating other metals are copper, nickel, silver, and gold, which are in each case made the anode or positive pole of a voltaic current, while the metal to be coated is made the cathode or negative pole. The electrolyte or immersing bath is differently composed, according to the metal which is to be deposited.

Electrically deposited copper is now largely used to protect and ornament architectural ironwork, the coating varying from 8 to 10 ounces per square foot for smooth plates, to 14 to 16 ounces for rough cast iron. For interior ornament electrobronzing is often employed, using a coating of from 2 to 3 ounces per square foot. In Europe it is common practice not to deposit the plating directly on the iron, but on a suitably prepared varnish, thus avoiding the necessity of cleaning, but at the same time giving a plating which is easily knocked off; in the United States the iron is very carefully cleaned and the copper deposited directly upon it, and so firmly that the original metal with its coating may be bent or twisted without rupturing the plating.

In the electrodeposition of nickel, or nickel

plating, the bath consists of nickel-ammonium sulphate dissolved in boiling water. The articles to be plated are first cleaned with abrasives or acids and after the plating is finished are polished. Gold and silver plating are employed in making jewelry, ornaments, and tableware of all descriptions. In silver plating the bath used is a solution of chloride of silver, cyanide of potash, and water. In gold plating either a hot or a cold solution may be used, and each is variously compounded, according to the result which it is desired to obtain. After the plating has been deposited the article is suitably burnished. The deposition of copper in electrotyping is one of the most important applications of electrochemistry and plays an important part in printing, under which title it is described. See ELECTROPLATING; PRINTING.

**Electric Furnace.** In the electric furnace there is not, as a rule, any electrolytic decomposition or electrolysis proper, but merely an extremely high temperature caused by the passage of the current . . . offering resistance. Thus, . . . production of the *Carbides*, by the action of the high temperature, a mixture of silica (sand), sodium chloride (salt), and coke silicon carbide (carborundum) is obtained. Similarly, by the action of the high heat on limestone, coke, and a flux, we obtain calcium carbide, from which acetylene gas is produced. The thermoelectric production of phosphorus has now replaced the older methods. Calcium phosphate is mixed with charcoal and sand and heated in the electric furnace, when the phosphorus liberated is distilled off in a current of coal gas. Artificial graphite is also made in connection with the manufacture of carborundum by volatilizing all but the carbon at still higher temperatures. See ELECTRIC FURNACE.

In the production of chemical compounds by electrical action we may mention, first, the electrolysis of alkaline chlorides. If the chloride, as sodium chloride (salt), is in the fused state, as in the Acker process, we obtain metallic sodium and chlorine. By a secondary reaction, that of steam on the sodium-lead alloy first obtained in this process, solid caustic soda is obtained, while the liberated chlorine is used to produce chlorinated lime or bleaching powder. If the chloride is in solution, as in brine, we may, by using a diaphragm, obtain caustic soda solution and chlorine at the two electrodes, or when no diaphragm is used, we may obtain as the sole product of the electrolysis an alkaline hypochlorite or a chlorate, according to conditions of temperature. The production of hypochlorite solution is now largely made use of for bleaching in textile works and in the paper industry. The production of chlorates electrolytically has largely replaced the older methods. (See SODIUM.) The decomposition of fused alkaline hydroxides is also practiced, as in the production of metallic sodium, by the Castner process, and latterly the production of metallic magnesium and calcium. Aluminium is produced in the Hall process by the electrolysis of aluminium oxide in a bath of fused cryolite. A number of organic chemical compounds are also produced at present by the aid of electrolysis. Chloroform and iodoform are thus made by the action of nascent electrolytic chlorine or iodine upon alcohol or acetone. Chloral is also a product of a similar action. A number of organic dyes are also produced with the aid of electro-

lytic action, either by oxidation or reduction. Among the lesser applications of electrochemistry may be mentioned the purification of sewage, the tanning of hides, the aging of wines, the production of ozone, the fixation of atmospheric nitrogen and manufacture of nitric acid, and the preparation of carbon disulphide.

**Bibliography.** For additional information, consult: Moissan, *Le four électrique* (Paris, 1897); Borchers, *Elektrometallurgie* (Brunswick, 1896); Haber, *Grundriss der technischen Elektrochemie auf theoretischer Grundlage* (Munich and Leipzig, 1898); Gore, *The Art of Electrolytic Separation of Metals* (London, 1894); id., *The Art of Electro-Metallurgy, Including All Known Processes of Electro-Deposition* (New York, 1900); Ahrens, *Handbuch der Elektrochemie* (Stuttgart, 1896, 1903); Arrhenius, *Text Book of Electrochemistry* (London, 1902); Stansfield, *Electric Furnace* (2d ed., 1913); *Transactions of the American Electrochemical Society* (South Bethlehem, Pa.); Norton, "Utilization of Atmospheric Nitrogen," *Special Agents Series*, No. 52, *Department of Commerce and Labor* (Washington, D. C.); *American Handbook for Junior Engineers*, ed. by Pender (New York, 1914).

**ELECTROCULTURE OF PLANTS.** The culture of plants under electric stimulus. It has long been known that plants respond to electric stimuli, and many investigations have been made to ascertain practical means of realizing the benefits of this force. The subject naturally divides itself into the direct use of the current when applied to the seed, plant, or soil, and the use of the electric light. The Abbé Nollet seems to have been one of the first to notice that the germination of seeds could be hastened by electrifying them before planting, and Bertholon carried on extensive experiments on electric stimulation of plants in 1783. Later, Specnew stimulated for a few minutes moist seed of beans, peas, barley, and sunflower, after which they were planted. Such seed germinated in half the time required for untreated seed. His experiments were repeated at the Massachusetts Experiment Station, where the germination was accelerated and the total germinations increased. Direct experiments upon the growth of plants have been made, in which zinc and copper plates, connected by wires, were placed in the soil in which the plants were grown, or wires were run through the soil and connected with a battery or electric machine of some sort. The first method has been successfully tried in England and Germany, with the result that larger crops of peas, barley, and grass were obtained from electrified plots of ground. The second method has been tried many times, the experiments of Warner at the Massachusetts Experiment Station being of this class. In 1893 he grew parsnips, lettuce, carrots, turnips, beets, salsify, onions, peas, and tomatoes. The seed of most varieties germinated sooner, developed better, and the tomatoes ripened earlier, where the soil was subjected to the electric current. The nearer the plants were to the electrodes, the better was the growth. More recently Stone, at the same experiment station, found that greater stimulation was secured by increasing the electric tension of the atmosphere than by passing the current through the soil. Alternating electric currents appear superior to direct currents for stimulating plants. Various forms of accumulators of atmospheric electricity have

been tried with greater or less success. That atmospheric electricity influences growth is shown by the experiments of Grandeau, who grew maize inside an insulated cage. The stalks were much smaller than those receiving the effect of the electricity of the air. The effect or advantage secured is explained by the fact that the electric current induces more rapid changes in the seed and soil, or that electrified plants are enabled to take up carbon dioxide more rapidly owing to the treatment. Lemström in Finland tried a special electric machine connected with a system of overhead wires, and while the apparatus was faulty an increase in the production of various crops was shown. Priestly, in 1910, gave an account of experiments carried on in England and Scotland by Sir Oliver Lodge, J. E. Newman, and others, in which the effect of overhead discharges of electricity on plants was studied. Installations were made in greenhouses and open fields, and earlier and more productive yields are reported for wheat, barley, cabbage, tomatoes, beets, carrots, and strawberries when stimulated by the discharge. These results seem to have been confirmed in Germany and France. Experiments by the United States Department of Agriculture have shown gains, but not sufficient to indicate that electroculture is commercially profitable.

The effect of the electric light has been very fully investigated at the experiment stations of Cornell University and West Virginia, the arc light being used at the former station and the incandescent lamp at the latter. In the case of plants grown under the electric light the effect seems to be exerted through the hastening and prolonging of the assimilation of the plants. A large number of vegetable and flower and foliage plants have been experimented upon. In the experiments with the arc light it was soon found that the naked light exerted an injurious effect upon many plants. This is believed to be due to the presence of ultra-violet rays, the spectrum of the electric light being unlike that of sunlight. A glass screen, as an ordinary globe, was found to cut out the injurious rays and to allow the beneficial rays to pass through. Hanging an arc light above a greenhouse had the same effect. By this method the flowering period of many plants was in some cases hastened, as with Easter lilies, being advanced as much as 10 days, and the colors were more intense. With vegetables the best results were secured with lettuce, plants of which were forced a week or more in advance of those in the unlighted portions of the house. This fact has been taken advantage of in a number of instances in the commercial forcing of lettuce. Similar results were obtained with the incandescent light at the West Virginia Experiment Station. The light from the mercury-vapor lamp, especially when quartz tubes are used, seems to be detrimental to plant activities.

The practical utilization of the electric light in horticulture seems at present limited to forcing lettuce and flowers. With these illumination for a month until midnight seems to give results commensurate with the expense. The whole subject is hardly beyond the experimental stage as yet, except as noted above. See ELECTROTAXIS; ELECTROTROPISM; GERMINATION.

**ELECTROCUTION** (from Gk. *ἤλεκτρον*, *ēlektron*, amber, electricity; a barbarous formation on the analogy of *execution*). A method of inflicting the death penalty by passing through

the body of the doomed criminal a current of electricity. It represents the latest attempt to rob the infliction of the death penalty of the revolting features of the prevalent mode of execution by hanging. While not entirely successful in this aim, it has in some parts of the United States been accepted as a more humane method of capital punishment than that which it is aimed to supersede. It has been adopted in New York, New Jersey, Pennsylvania, Massachusetts, Ohio, Indiana, Nebraska, Kentucky, North Carolina, South Carolina, Virginia, and Arkansas. The legislation which put it into effect in New York was based upon the recommendation of a commission appointed "to investigate and report to the Legislature the most humane and approved method of carrying into effect the sentence of death in capital cases." Notwithstanding the eminence of the commissioners, the prolonged and careful investigation which they gave to the subject, and the deliberate and cautious conduct of the Legislature in dealing with the report, the statute adopted for the purpose of giving effect to the conclusion of the commission, and changing the mode of executing the death sentence from hanging to electrocution, was assailed as unconstitutional, on the ground that it provided for the infliction of a cruel and unusual punishment. This contention was not sustained by the courts. On the contrary, they agreed with the commission that the application of electricity to the vital parts of the human body, under the conditions and in the manner contemplated by the statute, must result in instantaneous and painless death, and therefore would be a far more humane method of inflicting the death penalty than that by hanging. Consult *People ex rel. Kemmler v. Durston*, (119 New York Reports, 557, 1890), and 41 *Albany Law Journal* (242, 361, 382, 425, 489, 1890). See PUNISHMENT, and the authorities there referred to.

**ELECTROKINETICS.** See ELECTRICITY.

**ELECTROLYSIS.** For theoretical discussion, see ELECTRICITY; ELECTROCHEMISTRY, GENERAL.

**ELECTROLYSIS OF GAS AND WATER MAINS** (from Gk. *ἤλεκτρον*, *ēlektron*, amber + *λύσις*, *lysis*, dissolution, from *λύειν*, *lyein*, to loose). The eating away or disintegrating of the metal, caused by stray electrical currents. Electric street-railway systems are chiefly responsible for this action, through the lack of proper facilities for the return currents from the car motors to the power house. The softening or pitting of the pipes takes place where the current leaves them, particularly at joints, where the electrical resistance of the metal is greater than that of the surrounding earth. The danger from this source was so little realized in the early days of electric street railways that direct electrical connection was sometimes made with gas or water mains. Since about 1892 the problem has been assuming more and more serious proportions, and there have been numerous papers and discussions on this subject at the meetings of the various water works and gas associations. At the points of departure of these stray currents, whether permanent or temporary, the metal, be it iron, steel, or lead, is liable to become so badly decomposed as to be in serious danger of giving way. This is particularly true of water mains, which are under very many times as much pressure as gas mains. When water mains are thus broken, great damage may be done by the escaping

water, and a city or portion of a city might be at the mercy of the flames if a fire should break out. If, instead of the mains, the service pipes or house connections give way, the danger and inconvenience are not so great, but no end of trouble and much needless expense are often caused. Where gas mains fail, the ground becomes more or less permeated with gas, and if the latter has an opportunity to accumulate, an explosion may occur. Since 1890 water-works managers have had more and more trouble with electrolysis, and in several instances have felt compelled to sue street-railway corporations for damages and to ask the courts to enjoin the trolley companies from a continuance of the conditions which give rise to so much anxiety, expense, and danger. The final decisions of the courts have in all cases, however, held the railway companies blameless, provided the latter used all reasonable means to reduce the electrolytic action. It should be understood that the rails of the trolley lines are injured where the current leaves them, and that these imperfections in the circuit increase the power required to operate the railways. The remedy for the evil is to provide ample and unfailing means for the return of the current to the power house. Much can be effected, in the case of the ordinary single-wire overhead trolley, by a thorough bonding of the rails; but the consensus of opinion among water-works officials is that this is insufficient or unreliable, and that either the double overhead-trolley system or an underground return wire should be provided. Consult the *Journal of the New England Water-Works Association*, and the *Proceedings of the American Water-Works Association* for professional and technical papers on this subject, as well as a report from the Committee on Electrolysis to the American Electric Railway Association (1913), and Rosa and McCollum, *Technologic Paper No. 27, United States Bureau of Standards*, and other publications of the bureau.

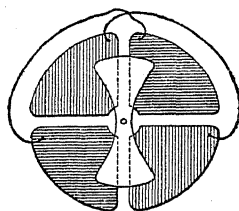
**ELECTROLYTES, DIFFUSION OF.** See DIFFUSION.

**ELECTROMAGNETIC INDUCTION.** See INDUCTION.

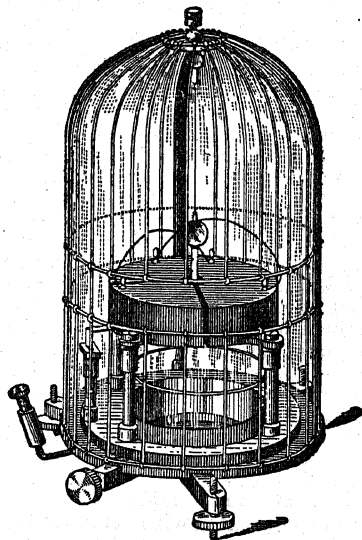
**ELECTROMETALLURGY AND ELECTRIC SMELTING.** See METALLURGY; ALUMINIUM; COPPER; GOLD; SILVER; PLATINUM; ZINC; ELECTRIC FURNACE.

**ELECTROMETER** (from Gk. *ἤλεκτρον*, *ēlektron*, amber + *μέτρον*, *metron*, measure). An instrument for measuring the difference of electrostatic potential between two charged conductors. The electroscope (q.v.) and the torsion balance (q.v.) are forms of electrometers and can be used to indicate the amount of electricity with which a given conductor is charged; but there are finer and more accurate instruments which are also based on the attraction and repulsion of two charged conductors. In the Peltier electrometer a thin vane of aluminium has attached to it a small magnet, whose magnetic moment is known, and which, being suspended at a point where the intensity of the earth's magnetism has been ascertained, enables us to determine the amount of any force which deflects it. There is a similar fixed arm which is charged with electricity of one kind, while the first vein is charged with electricity of the same kind. Consequently there is a repulsive action between the two, whose extent depends upon the charges which the two conductors have. The capacity of these conductors is always the same;

consequently the amount of electricity with which they are charged must depend upon the difference of potential; and this rule holds good in most forms of electrometers. A more accurate form of electrometer consists in balancing the mutual attraction of two charged plates by weights. A charged disk with a plain surface is attached to one arm of a balance, but electrically insulated from its metallic parts. By means of balancing weights or the movement of the arm of the balance, the strength of attraction can be determined. This device, which was invented originally by Snow Harris, was later improved by Lord Kelvin and was an instrument quite delicate in its action. In Lord Kelvin's hands it furnished valuable results and was known as an absolute electrometer. He also devised the quadrant electrometer, where there is a needle of thin aluminium suspended over four quadrants which are connected in pairs. A charge of electricity is communicated to one pair of quadrants diametrically opposite each other, and a charge of the opposite kind is given to the other pair, or they are connected with the earth. The needle, therefore, will be attracted by one set of quadrants and repelled by the other, the amount of deflection measuring the potential difference to which the quadrants are charged. The action of the apparatus will be understood on reference to the illustration. Here the needle is charged by an electrophorus or is in contact with a Leyden jar, and the two sets of quadrants are charged to the difference of potential which it is desired to measure. The amount of deflection can be determined accurately by using a reflecting mirror on the needle and a telescope and scale, as is done with



QUADRANT ELECTROMETER.



LORD KELVIN ELECTROMETER.

the galvanometer (q.v.), and it is possible to measure even such small differences of potential as those of the two elements of a cell. The form of electrometer illustrated is supplied with a replenisher in the shape of a small Leyden



jar at its base, and the quadrants are made double, or box shape, to increase the effect. In the electrostatic voltmeter used in the measuring of alternating currents a vane of aluminium is delicately pivoted, so that it may revolve between two brass plates from which it is insulated. The vane is connected with one conductor from the alternator, or other source of current, while the other conductor is connected with the fixed brass plates. When the vane and the plates are charged, there is a repulsive action between them, and the vane is revolved. The pointer attached to one arm moves over a graduated scale, indicating the difference of potential, and counterweights of different amounts may be placed on the lower arm so that the range of the instrument can be varied and several sets of readings for different ranges of potential obtained. By increasing the number of vanes and fixed plates the sensitiveness of the instrument is increased, and it is then termed a multicellular voltmeter. In the study of radioactivity quadrant electrometers of very small size, and therefore small electrical capacity, are used where the needle is made of paper, aluminium foil, or silvered mica, suspended by a quartz fibre or very fine phosphor bronze strip, and so light that no damping beyond air friction is required. With a fine fibre the sensitiveness may be as great as a scale division for a potential difference between the quadrants of  $\frac{1}{10,000}$  of a volt, so that currents can be measured far smaller than with the best galvanometer. The capillary electrometer of Lippman and Dewar, used to measure small differences of potential, consists of a glass tube placed horizontally, with its ends turned up and filled with dilute acid. At the middle of this tube is placed a drop of mercury, and as the current passes through the acid the drop travels along the tube towards the negative pole. This action is due to a change in the surface tension between the mercury and the acid, caused by the liberation of gas. Other electrometers figure mostly in experiments in static electricity and for accurate determinations requiring careful manipulation. Consult: Thompson, *Elementary Lessons in Electricity and Magnetism* (rev. ed., Chicago, 1906); Müller-Pouillet-Pfaundler, *Lehrbuch der Physik* (Brunswick, 1898); Rutherford, *Radioactivity* (Cambridge, 1905); Hallo, *Elektrische und magnetische Messungen und Messinstrumente* (Berlin, 1906). See TERRESTRIAL ELECTRICITY.

**ELECTROMOTIVE FORCE.** See ELECTRICITY, *Electrokinetics*; *American Handbook for Electrical Engineers*, ed. by Pender (New York, 1914); also ELECTROCHEMISTRY, GENERAL.

**ELECTRON.** A particle of matter, charged with negative electricity, having a mass about  $\frac{1}{1836}$  part of that of the hydrogen atom, probably a common constituent of the atoms of all chemical elements. The electron hypothesis assumes that the charge on an electron is the natural unit or atom of negative electricity, and that the existence of a negative charge on a body results only from the congregation there of electrons.

The recognition of the separate existence of particles of mass smaller than that of the hydrogen atom is due to Sir William Crookes, who took the position that the luminous streams ("cathode rays") that proceed from the cathodes of highly exhausted vacuum tubes are composed of tiny material particles moving away from the cathode like a storm of pro-

jectiles. He did not definitely commit himself to any theory as to the precise nature of these particles, but recognized them as being somehow different from the ordinary molecules of matter and maintained that the cathode rays presented "a new or fourth state" of matter. His views, though opposed strenuously at first by competent authorities, have been substantiated and extended by subsequent experiments.

J. J. Thomson, in 1897, succeeded in completely demonstrating the general correctness of Crookes's hypothesis and in defining very closely the nature of the rays. He found that they consisted of negatively charged particles, moving with velocities varying between 20,000 and 50,000 miles per second, and that the mass of these particles was about  $\frac{1}{1836}$  that of the hydrogen atom. He also showed that electrons of the same small mass could be produced in a variety of ways. They are emitted from a metal plate exposed to ultra-violet light, from the surface of glowing metals, from the electric arc, and from flames. In all these cases an external stimulus and supply of energy is necessary to free the electron, but it is found that the radioactive substances, radium, thorium, uranium, etc., spontaneously and continuously emit these small, negatively charged particles with a wide range of velocities, in some cases  $\frac{1}{10}$  that of light. The charge on the electron in all these cases is found to be the same and equal to  $4.77 \times 10^{-10}$  electrostatic units. It has been shown that the charge carried by the electron or a gaseous ion is the same as that on a monovalent ion in electrolysis, and it thus seems to be a natural and indivisible unit of electricity.

The constancy of the charge and the mass of the electron, whatever its origin, naturally led to the view that all matter contained this primordial element. The conception of an atom consisting of a number of mobile negative electrons embedded in a sphere of positive electrification was embodied by Lord Kelvin in a paper called "Aepinus Atomized." This electronic model has been further developed by J. J. Thomson, who has investigated the properties of model atoms, consisting of a large number of rapidly revolving electrons held in equilibrium by these mutual repulsions and the forces due to a fixed distribution of positive electricity. He has shown that such systems imitate strikingly many of the most fundamental properties of chemical atoms.

Such an atom furnishes a ready means of explaining the mechanism by which the radiation of the electromagnetic waves of light by matter is effected. These charged particles within the atom radiate no energy unless subjected to an acceleration; but if one is displaced from its position of equilibrium, it will vibrate about its mean position of rest and radiate electromagnetic energy into space until brought to rest. From this view of the origin of radiation Lorentz pointed out that, if a source of light were subjected to an intense magnetic field, it was to be expected that the lines of the spectrum should be broadened, and this prediction was later experimentally verified by Zeeman, who found that the spectrum lines were not only spread out, but completely split up into three or more lines. Measuring the distance between these lines, it may be shown that the ratio of the charge to the mass of the vibrating particles to whose disturbance the lines are due is the same as the ratio for the electron as reached by other methods.

The problem of the conduction of electricity along metal conductors has also been attacked on the same ground by Thomson and Drude. On the electronic theory all conductors are supposed to contain a large number of free negative electrons which can pass freely between the atoms of matter. These electrons are considered as moving freely to and fro in the spaces between the molecules of the metal. Under the influence of an electric field the electrons are set in motion and act as the carriers of the current, the positive carriers remaining either immobile or moving very slowly.

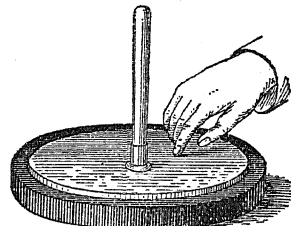
The nature of the electron, whether it is a fragment of an atom of matter or a disembodied electric charge, so that all its properties can be accounted for by purely electrical theory, has been somewhat elucidated by the following considerations. A moving charge behaves like an electric current and produces a magnetic field about it. Electromagnetic energy therefore is stored up in the medium and travels with the moving charge, and the amount of this energy is proportional to the square of the speed for speeds small in comparison to the velocity of light; but when a mass is set in motion, it possesses kinetic energy proportional to the second power of its speed. As work is done when the speed of a mass is changed, so it must be done when the speed of an electric charge is changed; therefore an electric charge possesses inertia or mass, the fundamental property of matter. It will tend to resist any acceleration. If we consider a charged body, its inertia or mass is due partly to the neutral body and partly to the charge on it.

In experiments by Kaufmann to determine how far the mass of the electron results from the charge associated with it, radium was used as a source of electrons, as it expels electrons with a wide range of velocities, some being as high as .9995 that of light. By an ingenious experiment Kaufmann determined the mass of the electron at different speeds, found that it increased rapidly as the velocity of light was approached, and, by comparison of theory with experiment, showed that the mass of the electron was purely electrical in origin. It is therefore probable that it is a disembodied charge, possessing, however, the characteristic property of mass in virtue of its charge.

**Bibliography.** Consult: Thomson, *Conduction of Electricity through Gases* (Cambridge, 1903); Lodge, articles on "Electron," the *Electrician* (London, 1903); Abraham, *Mechanik der Electrons* (Göttingen, 1902); Abraham and Langevin, *Les quantités elementaires d'électricité: Ions, Electrons, Corpuscles* (Paris, 1905); Ames, *The Constitution of Matter* (Boston, 1913).

**ELECTROPH'ORUS** (Neo-Lat., from Gk. ἤλεκτρον, *ēlektron*, amber + -φορος, -*phoros*, bearing, from φέρειν, *pherein*, to bear). This apparatus consists of a circular disk of hard rubber, vulcanite, shellac, or other insulating material in a metallic surface or form, and a movable metal cover with an insulating handle. The disk is first negatively electrified by being struck briskly with a foxtail or catskin, and then the metal cover is placed on it. The next step is to touch the cover with the finger, which may produce a slight spark, and then grasping the insulating handle to raise it, keeping it parallel to the surface of the disk. If presented to the finger or any body in contact with the ground,

a spark will ensue, and this can be secured for a number of times by simply placing the cover on the disk, touching it with the finger, and removing. This process can be repeated until the disk loses its charge by leakage into the air. The action of the electrophorus depends upon induction and the underlying principle is the same as in the electrical machine and other electrical apparatus. When the vulcanite or shellac is rubbed, it is negatively charged, the charge residing somewhat below the surface. Now, when the cover is put on, the negative charge of the disk acts on the plate inductively, attracting the positive electricity to the lower side and repelling the negative to the upper side. When the finger is brought into contact with the metal, it affords an opportunity for this negative electricity to escape to the ground and leaves the cover with a positive charge which is held bound. Raising the cover now positively charged and bringing it near some object in connection with the ground, we have a sharp spark as the equilibrium is restored and the plate discharged. The electrophorus can be used to charge bodies and perform a number of experiments in frictional electricity. See ELECTRICITY.



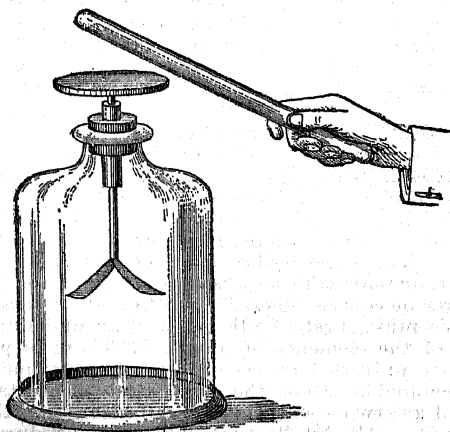
ELECTROPHORUS.

**ELECTROPLATING.** A process by means of which salts of gold, silver, platinum, nickel, copper, or other costly metals are decomposed by an electric current, a coating of metal being deposited on the surface of objects made of some cheaper metal. In 1838 Jacobi, of St. Petersburg, published a description of a method capable of reproducing any line engraved on copper into a relief by galvanic process. Soon after Thomas Spencer, of Liverpool, independently announced his discovery of a similar process. From these discoveries have grown the extensive electroplating processes that include the deposition of gold, silver, copper, nickel, and other metals. In order to obtain a reproduction—as, e.g., a medal or similar object—a mold or cast is made on which the layer of metal is to be deposited by the current. This is sometimes of an inferior metal, as base or white metal; or, as in the case of type, of a mold made of some nonconducting material, such as wax or gutta-percha, which must be carefully brushed over before immersion with very finely powdered graphite. (See PRINTING.) In order that the metal to be deposited may adhere perfectly to the object to be plated, it is necessary that it shall be perfectly clean; it is therefore usually dipped in a cleansing solution, as of an acid or a caustic alkali, and then rinsed in water to remove all traces of the cleansing solution. The Bunsen, Daniell, Grove, and Smee batteries are often used to supply the current for electroplating small objects; but for commercial purposes it is customary to employ a dynamo machine. The solutions employed in electroplating are very numerous; but in ordinary commercial practice they consist of the following salts dissolved in distilled water: for *gold*, a solution of gold cyanide and potassium cyanide; for *silver*, a solution of silver cyanide and potassium cya-

nide; for *copper*, an ammoniacal solution of copper and potassium cyanide; for *nickel*, a solution of nickel and ammonium sulphate, or of the corresponding chloride. The electrolysis is effected in a convenient bath, which, when small objects are to be plated, may be of glass or porcelain, but in commercial practice is a trough lined with a nonconducting material. The latter may be wood or cement, in the case of silver; zinc, in the case of copper; and asphaltum, in the case of nickel. The object on which the metal is to be deposited is connected by a wire with the negative electrode of the battery, while the positive pole is connected with an anode of the same metal which is to be deposited on the object, thus closing the circuit. As fast as the solution is decomposed the liberated acid dissolves the metallic anode, in consequence of which the solution is kept in about the same state of concentration.

Consult: McMillan, *Treatise on Electro-Metallurgy* (London, 1899); Partridge, *A Practical Treatise on the Art of Electrotyping* (Chicago, 1899); Urquhart, *Electro-Plating: A Practical Handbook on the Deposition of Copper, Silver, Nickel, Gold, Brass, Platinum, etc.* (London, 1894); Van Horne, *Modern Electro-Plating* (Chicago, 1897); Watt, *The Electro-Plating and Electro-Refining of Metals* (London, 1902); Weston, *Electro-Platers' Handbook* (Chicago, 1905); Barclay and Hainsworth, *A Treatise on the Electro-Deposition of Metals* (New York, 1912); Langbein, *Complete Treatise on the Electro-Deposition of Metals* (7th ed., Philadelphia, 1913); Reama, *Electroplating and Analysis of Solutions* (Brooklyn, 1913). See ELECTROCHEMISTRY, INDUSTRIAL.

**ELECTROSCOPE** (from Gk. ἤλεκτρον, *ēlektron*, amber + σκοπεῖν, *skopein*, to look). An instrument for the detection of the presence of electricity. It depends for its action on the principle that bodies charged with like electricity repel, while those charged with unlike electricity attract, each other. The ordinary pith ball suspended on a silk thread is the simplest form of the instrument. The most common type of electroscope is that devised by Bennet in 1787 and



ELECTROSCOPE.

known as the gold-leaf electroscope. It consists of two strips of gold leaf, or thin aluminium foil, suspended from the lower extremity of a conductor within a glass bottle or jar. The upper end of the conductor terminates in a ball,

or a plate in case the instrument is to be used as a condensing electroscope. (See CONDENSER.) If a body charged with positive electricity is brought near to the knob of the electroscope, the negative electricity will be attracted to the knob and the positive repelled to the leaves, which then diverge. If now the finger is touched to the knob, the positive electricity is drawn off and the leaves collapse, while the negative electricity is held bound. Removing the charged body, the leaves will then diverge again, charged with negative electricity. In this case the instrument can be used to determine the nature of the charge of a body brought near it, as with a positive charge the leaves will collapse, and with a negative charge spread farther apart. In the Bohnenberger electroscope a strip of gold leaf is suspended between the poles of a dry pile (q.v.). If a charge is communicated to the gold leaf, it will be deflected towards one or the other of the two poles.

Much use has been made of the gold-leaf electroscope in the study of radioactivity, and several forms of the instrument have been devised that are used as electrometers rather than electroscopes. For the sort of measurements necessary in the study of the natural ionization or conductivity of the atmosphere, and the like, a well-designed gold-leaf electrometer has as great sensitiveness as a quadrant electrometer, is almost as reliable, and has the advantage of extreme simplicity. For a description of these modern electroscopes, consult Rutherford, *Radioactivity* (Cambridge, 1905). See TERRESTRIAL ELECTRICITY.

**ELECTROSTATICS.** See ELECTRICITY.

**ELECTROTAXIS** (Neo-Lat., from Gk. ἤλεκτρον, *ēlektron*, amber + τάξις, *taxis*, arrangement, from τάσσειν, *tassein*, to arrange). The sensitiveness of motile organisms to the direction of an electric current passing through the medium in which they are living. In given strengths of current some organisms orient themselves parallel to the lines of the current and swim towards the anode (positive), others towards the cathode (negative), and still others orient themselves and swim at right angles to the line of the current (*dia*). Variation in the strength of the current causes a reversal of response in some cases. It bears the same relation to electrotropism that chemotaxis does to chemotropism. See ELECTROTROPISM.

**ELECTROTROPISM** (from Gk. ἤλεκτρον, *ēlektron*, amber + τροπή, *tropē*, a turning, from τρέπειν, *trepein*, to turn). Sensitiveness of plant organs to the electric current or to electrical radiations; so called in analogy to other tropisms. (See GEOTROPISM, etc.) The response of plant organs to electrical radiations has been little studied, and the data justify no conclusions. To a current of low strength plant organs show a negative response (cathodic), to strong currents positive bending (anodic); and to currents of intermediate strength no reaction. It is the strength of the current passing through the organ itself rather than the bathing liquid that determines the bending. While the negative curvature is a true tropic response, the positive is not, but is due to the injury and cessation of growth of the organ on the anodic flank. An organ showing positive bending soon completely succumbs. In the case of negative bending in roots the tip is the perceptive zone and the quantity of stimulus law apparently applies. The injury in positive bending is probably due to the accumulation of poisonous ma-

terials (anodes) in the cells of the anodic flank.

**ELECTROTYPING.** See ELECTROCHEMISTRY, INDUSTRIAL; ELECTROPLATING; PHOTO-ENGRAVING; PRINTING.

**ELECTRUM** (Lat., Gk. *ἤλεκτρον*, *ēlektron*, amber, probably on account of its color, *ἤλεκτρος*, *ēlektros*, alloy of gold and silver). A term applied to native alloys of gold and silver. According to Pliny, the term "electrum" was applied to native gold containing at least 20 per cent of silver. Electrum was used since the seventh, and possibly even since late in the eighth century B.C. Its earliest usage was limited to purposes of inlaying, but later it was very extensively used as a material for coins.

**ELEGIT** (Lat., he has chosen), WRIT OF. A form of execution first authorized by the Statute of Westminster (13 Edw. I, c. 18), for the seizure and sale of one-half the lands owned by a judgment debtor. At common law land was not liable for the debts of its owner, because its forced sale to a stranger would have resulted in the destruction of the feudal relation of lord and tenant. By the Statute of Westminster, however, the judgment creditor was allowed to choose between a writ against the debtor's land and an execution by writ of fieri facias against his person or chattels. The new writ was called an *elegit*, because it represented this choice or election on the part of the creditor. The creditor, upon the writ, was regarded as having a *chose in* estate in the lands so held, not unlike the modern mortgage, which estate, because it was held as security for a personal debt, was treated as personal property ("chattel real" was the technical description) which would descend to the creditor's executor and not to his heir. The payment of the debt for which the writ was levied divested the estate by *elegit* and revived the title of the debtor. This remedy by *elegit* proved so convenient that it was subsequently extended (1 and 2 Vict., c. 110, § 11) so as to permit the seizure of the whole of the debtor's lands, and in this form it has survived to the present time in England and some of the United States. In most of the States, however, it has been superseded by other and simpler devices for securing the satisfaction of a judgment. Originally the creditor could only hold the lands—taking the rents and profits until the debt was satisfied; but the power to sell and apply the proceeds to the debt is now usually an incident of the estate by *elegit*. See EXECUTION, and consult the authorities there referred to; also Blackstone's *Commentaries on the Laws of England* (4th ed., 2 vols., Chicago, 1899) and Kent's *Commentaries on American Laws* (14th ed., 4 vols., Boston, 1902).

**ELEGY** (Lat. *elegia*, Gk. *ἐλεγία*, *elegeia*, elegy, from *ἔλεος*, *ēlegos*, mourning song). A word employed at an early period by the Greeks to designate a poem, usually short, written in distichs. (See DISTICH.) The alternation, peculiar to this measure, of the hexameter with the pentameter gives to this species of poetry its individual character. Of the numerous elegies of the Greeks, few have come down to us. Those still extant consist partly of encouragements to patriotism. Among the Romans, the term "elegy" was applied especially to love poems. Catullus was the first good Roman elegiac writer; after him came Propertius, Tibullus, and Ovid. Tibullus, in particu-

lar, brought the erotic elegy to its highest perfection. (Consult Jebb, *The Growth and Influence of Classical Greek Poetry*, pp. 95-103, Boston, 1894, and the introduction to K. F. Smith's edition of Tibullus, New York, 1913.) In modern times the term elegy is applied where a tone of melancholy pervades a poem. In English the word is generally understood as a name for lyrics that are laments over the dead, as, e.g., Milton's *Lycidas*, Shelley's *Adonais*, and Arnold's *Thyrsis*. The dirge is a kind of elegy, but, specifically, a funeral lamentation, expressive of a more immediate and poignant grief than the reflective sadness of the elegy.

Elegy, in music, is a composition depicting feelings of mourning, sadness, longing or ardent desire, and love.

**ELEGY WRITTEN IN A COUNTRY CHURCHYARD.** A poem by Thomas Gray (q.v.). It was finished in 1750, although it was begun seven or eight years before. The original churchyard is thought to have been that of Stoke Poges in Buckinghamshire. The poem first appeared on Feb. 16, 1751, rapidly ran through a number of editions, still retains its popularity, and has become an English classic.

**ELEK'TRA.** A music drama by Richard Strauss (q.v.), first produced at Dresden, Jan. 25, 1909; in the United States, Feb. 1, 1910 (New York).

**ELEMENTAL SPIRITS.** Beings who, according to the popular belief of the Middle Ages, presided over the four "elements," living in and ruling them. In a work attributed to Paracelsus the elemental spirits of fire are called salamanders; those of water, undines; those of the air, sylphs; and those of the earth, gnomes.

**ELEMENTARY SCHOOLS.** See COMMON SCHOOLS; SCHOOLS.

**ELEMENTS.** In astronomy, the numerical quantities employed in computing the position of a planet at any time. They are (1) the semimajor axis of the orbit; (2) the eccentricity; (3) the inclination of the plane of the orbit to the plane of the ecliptic; (4) the longitude of the ascending node; (5) the longitude of perihelion; and (6) the epoch. Sometimes the period, or the mean angular daily motion, which, by Kepler's Third Law, depends on the semi-major axis of the orbit, is also given. See COMET; PLANETS; ORBIT.

**ELEMENTS, CHEMICAL.** See CHEMISTRY; ATOMIC WEIGHTS; PERIODIC LAW.

**ELEMENTS, CONSCIOUS.** One of the principal problems of psychology is to analyze into their simplest constituent processes the mental complexes (perceptions, ideas, emotions, actions) that occur in everyday experience. These simplest, unanalyzable processes are termed the "elements of consciousness." See CONSCIOUSNESS.

We must, first of all, get a clear understanding of the elements of mind. 1. There is practically universal agreement among experimental psychologists that the structural elements of mind are two—sensation and affection (see these terms). All intellectual experiences reduce to sensation; all emotional and volitional experiences are compounds of sensation and affection. The mental organism is, so to speak, made up of these two types of process, as the bodily organism is made up, from the anatomical standpoint, of certain forms of cells. Both elements are determined by analysis and abstraction; neither

occurs alone in conscious experience. In the case of affection the final court of appeal is introspection; that is simple which self-observation declares to be simple. In the case of sensation there are two possibilities of decision. We may regard sensation (*a*) as a psychological ultimate or (*b*) as a psychophysical ultimate. (See PSYCHOPHYSICS.) Thus, the color red is unanalyzable in introspection; it is a psychological sensation. But in psychophysics red is the resultant of a chromatic (red) and an achromatic (white or gray) excitatory process. Psychophysically, therefore, the color is a fusion quality—a perception, not a sensation. It is immaterial which of the two “ultimates” we take as the basis of our reconstruction of mind from the elements, but we must be careful not to confuse them. 2. Psychologists, again, are fairly well agreed upon the question of the principal mental functions, though they differ as to which of these should be considered elemental. Brentano posits three ultimate functions—presentation or ideation, judgment or belief, and interest or emotion (love and hate). Stout recognizes cognition (including, as integral constituents, sentience, simple apprehension, and belief) and volition; this latter includes the fundamentally distinct functions of feeling (being pleased and displeased) and conation (desire and aversion). Wundt, on the other hand, regards impulse, a volitional process compounded structurally of sensation and affection, as the one typical form of mental function from which all the rest are derivative. 3. Impulse is further, for Wundt, the primordial manifestation of mind. This view is, of course, not shared by those who regard the reflex movement as primitive and believe that mind has in some way been superinduced upon unconscious bodily activity. In any case, the genetic definition of “element” must be sharply distinguished from the structural definition. See ACTION.

Consult: Stout, *Analytic Psychology* (London, 1896); Brentano, *Psychologie* (Leipzig, 1874); Wundt, *Outlines of Psychology* (Eng. trans., ib., 1902); id., *Physiologische Psychologie* (ib., 1902–03).

**ELEMENTS, ELECTROCHEMICAL, ORDER OF.** See ELECTROCHEMISTRY, GENERAL; CHEMISTRY.

**ELEMENTS, SACRAMENTAL.** See LORD'S SUPPER.

**ELEMI**, él'-mī (Fr. *élémi*, of doubtful etymology). A fragrant resinous substance, obtained from different plants of the family Burseraceæ. It was formerly brought chiefly from Egypt or Ethiopia and was referred to a tree called *Amyris plumieri*. Part of the elemi of commerce is now obtained in America, from trees of other genera of the same family, particularly *Protium icicariba*. In dry weather incisions are made in the bark, from which the resinous juice flows abundantly, hardens in the sun, and becomes brittle with age. Mexican or Vera Cruz elemi is derived from several species of *Bursera*. Manila elemi is produced by *Canarium commune*. Elemi is seen in the trade usually in large, pale yellow, semitransparent masses; fragile, softening by the heat of the hand; with a smell somewhat resembling that of fennel. It is soluble in alcohol and leaves a white crystallizable residue, which is very light, inodorous, and tasteless, and which is called elemine. The properties of elemi, however, chiefly depend on a volatile oil, which may be obtained from it by distillation. Elemi is

used in the preparation of stimulant plasters and ointments and is extensively used as an incense in Eastern countries.

**ELE'OLITE.** See ELÆOLITE.

**ELEPHANT** (AS. *elpend*, OF. *olifant*, *elifant*, Lat. *elephus*, from Gk. *ἐλέphas*, possibly from *ἐλ-*, *el*, horn + *-phas*, *-ephas*, Lat. *ebur*, ivory, from Egypt. *abu*, *ab*, Copt. *edou*, *ehu*, elephant). An ungulate mammal of the suborder

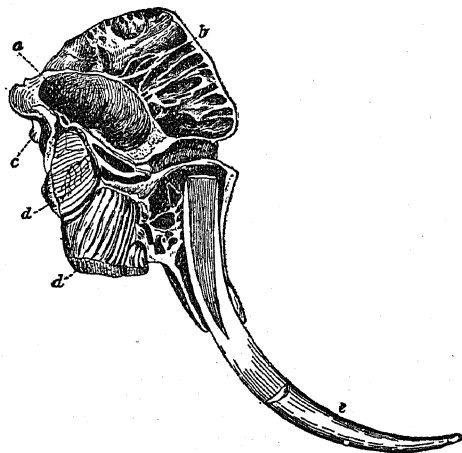


FIG. 1. SKULL OF AN INDIAN ELEPHANT.

Vertical section of the skull, with the molars and incisor (tusk) of one side: *a*, brain cavity; *b*, cavernous upper part of the cranium, showing its cellular cavities; *c*, condyle; *d*, *d*, molars; *e*, tusk.

Proboscidea and family Elephantidæ, representing by two species the largest existing land animals. The ordinary height at the shoulder is about 8 feet, but occasionally exceeds 10 feet, and has been known in one case, in Ceylon, to reach 12 feet. The weight of a large elephant is about five tons, the body being very bulky in proportion to its height. To sustain this weight, it is furnished with limbs of colossal thickness and strength, which are also remarkably straight, each bone resting vertically on that beneath it. In lying down, the elephant does not bring his hind legs under him, like other quadrupeds, but extends them backward as a man does when kneeling. The elephant's pace, when exceeding a walk, is neither a trot nor a gallop, but a sort of shuffle, the speed of which is increased or diminished without change of gait.

**Structure.** The head in elephants is large; the neck is short and thick, the long flexible proboscis enabling the animal readily to reach objects on the ground or at a height or distance of several feet. A great extent of bony surface in the head affords attachment for muscles destined to move and give power to the proboscis or trunk, yet the head is light in proportion to its bulk, as a great space separates the internal and external tables of all the bones of the skull, except the occipital bones, so that the brain chamber is but a small part of the whole head. The space between the tables of the bones is occupied by cells, some of which are 4 or 5 inches in length, which connect with each other and are filled with air, making the vast skull comparatively light.

**Trunk.** The nasal bones of the elephant are scarcely more than rudimentary; but the tapering proboscis, to the very extremity of which

the nostrils are prolonged, is nearly 8 feet in length. Besides the great muscles connected with it at its base, it is composed of small muscles variously interlaced, which Cuvier estimated at not much less than 40,000. The trunk can be coiled around a tree and employed to tear it from its roots; it is a formidable weapon of offense and defense and is far more employed in this way than the tusks. Its extremity may be wound around a small handful of grass or a slender branch, and it is capable of picking a surprisingly small object from the ground. To fit it for such actions as a man might perform by a hand, the trunk of the Indian elephant is furnished at the extremity with what may be likened to a finger and thumb—on the upper side, an elongated process, soft, strong, flexible, and endowed with the most delicate sense of touch; on the under side, a kind of tubercle against which this process may be pressed. All the food of the elephant is gathered and conveyed to the mouth by the trunk; by means of the trunk, also, it drinks, sucking up a quantity of water sufficient to fill it and then discharging the contents into the mouth. Valves at the base of the trunk prevent the water from going too far up the nostrils. The trunk is constantly employed by elephants in providing in many ways for their comfort and enjoyment, as in throwing dust or spouting water over their backs, two practices to which they are greatly addicted. Their friendly caresses are also given by the trunk, and through it they make a loud shrill sound, indicative of rage. With the trunk, also, they are able to strike powerful blows.

The sense of smell is very acute in the elephant, as is also that of hearing. The ears are large and pendulous; the eyes are small.

**Teeth.** Elephants have no canine teeth, nor have they any incisors in the lower jaw. The upper jaw is furnished with two incisors which, in perfection, become enormous tusks, sometimes weighing from 150 to 200 pounds. They are preceded by milk teeth, shed at an early age, and they consist almost wholly of solid dentine, the fine elastic quality of which renders it invaluable as ivory (q.v.) for various uses in the arts. A peculiarity of its structure is that in a cross section "striae proceed in the arc of a circle from the centre to the circumference in opposite directions, . . . as in the engine turning of a watch." The tusks vary greatly in size, being sometimes very small, and they are often malformed or wholly broken off. Elephants employ them for such uses as grubbing up edible roots or loosening the roots of trees which they cannot otherwise tear from the ground; as weapons (by thrusting), especially in maintaining discipline

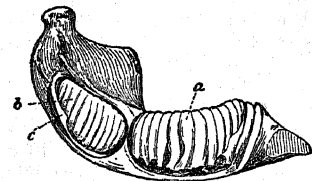


FIG. 2. MOLAR TEETH.

a, penultimate molar; b, germ of the last molar; c, bony capsule of the alveolus, which moves forward with the tooth.

in a herd; and in domestication for carrying light sticks of timber, held in place by the trunk. The molar teeth of the elephant are developed in succession; and, at least in the Indian elephant, never more than two are to be seen in the same side of a jaw at one time. The

first molars cut the gum in about two weeks after birth and are shed about the end of the second year. The sixth molars, which are also believed

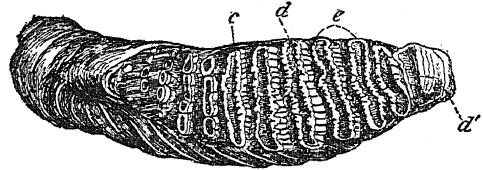


FIG. 3. MOLAR OF INDIAN ELEPHANT.

d, dentine; d', dentine worn down to common base; e enamel; c, cement.

to be the last, are supposed to appear about the fiftieth year of the elephant's life. The molar teeth of the elephant are remarkable for their great size and for the extreme complexity of their structure. They are composed of vertical plates of bony substance, separately enveloped in enamel and soldered together by a third substance, "cement," more resembling bone than enamel. Each succeeding tooth is not only more complex, but occupies a greater space in the jaw than its predecessor. Although formed from a single pulp, the molar tooth of an elephant resembles an aggregation of teeth; and in the earlier stages of its growth, when the cement is not yet deposited, it seems as if many separate teeth were soldered together. As the surface of the tooth is worn down by mastication, the harder enamel is exposed in elevated ridges; from the peculiar manner of its growth, the anterior part begins to be employed and to

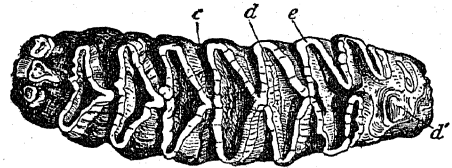


FIG. 4. MOLAR OF AFRICAN ELEPHANT.

Grinding surface of the penultimate lower molar. Letters as in Fig. 3.

be worn away while the latter part is still in process of formation.

**Functions.** The digestive apparatus of the elephant is similar to that of other herbivorous animals; but the stomach, which is of a very lengthened and narrow form, has near the gullet a reservoir for water, capable of containing several gallons, while a peculiar muscle, connecting the windpipe and gullet, enables the animal to regurgitate the fluid, which may then be sucked from the mouth into the trunk and squirted over the body or at some offending man or animal.

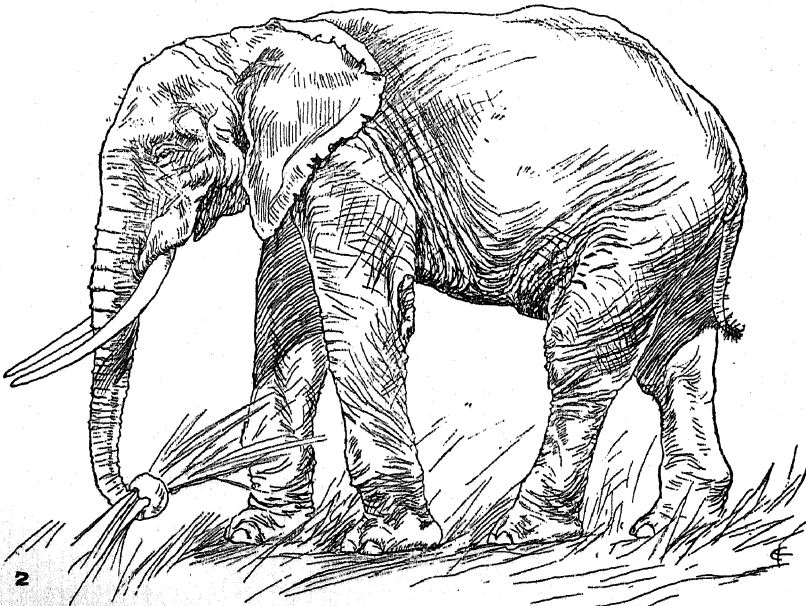
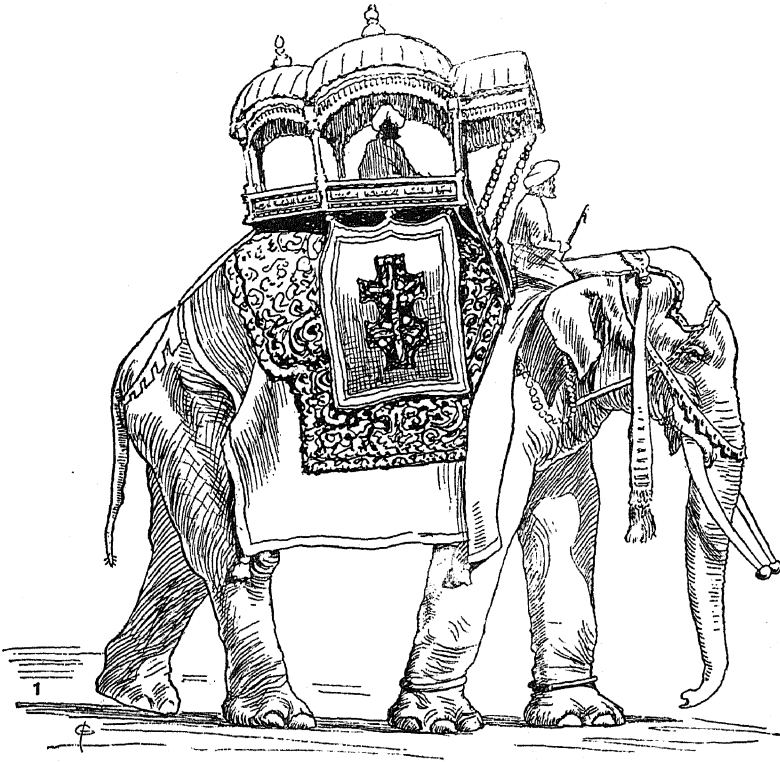
The female elephant has only two teats, situated between the forelegs. The young suck with the mouth and not with the trunk. They are suckled for about two years. The period of gestation is also nearly two years, and a single young one is produced at a birth.

The skin of the elephant is very thick, of a dark-brown color, and in the existing species has scarcely any covering of hair. The tail does not reach to the ground and has a tuft of coarse bristles at the end. The feet have toes, each incased in a kind of hoof.

**Habits, etc.** Elephants live in herds, not



## ELEPHANTS



1. INDIAN ELEPHANT (*Elephas indicus*), with howdah

2. AFRICAN ELEPHANT (*Elephas africanus*)



generally numerous, but several herds often congregate together in the same forest or at the same place of drinking. Each herd has a leader, generally the largest and most powerful animal. The leader seems to exercise much control over the herd, gives the alarm in case of danger, and seems to examine and decide for the whole herd as to the safety of proceeding in any particular direction. A family resemblance is usually visible among the elephants of the same herd; some herds are distinguished by greater stature, and others by more bulky form and stronger limbs; some by particularly large tusks, some by slight peculiarities of the trunk, etc. In the East Indies distinctions of this kind have long been carefully noticed, and some are considered as "high-caste," others as "low-caste," elephants. An elephant which by any cause has been separated from its herd seems never to be admitted into another, and these solitary males are particularly troublesome in their depredations, exhibiting an audacity which the herds never show; they are also savage and much dreaded, while from a herd of elephants danger is rarely apprehended. These remarks apply especially to the Asiatic species.

The favorite haunts of the African elephant are mountainous districts with a scattered tree growth; but the Asiatic species keeps itself in the depths of forests, particularly in mountainous regions, where they browse on branches or eat herbage, roots, etc., and from which they issue chiefly in the cool of the night to pasture in the more open grounds. They feed largely on the young shoots of palm trees, and crush and eat the coconuts, after rolling each one under foot to rub off the husk; and they often do vast damage to crops.

Elephants delight in abundance of water and enter it very freely, often remaining in it for a considerable time and with great evident enjoyment, swimming with ease and skill.

Two species of elephant only survive the decay of a family much more numerous and widespread in the geological period that preceded the present—one African and the other Asiatic. For fossil and extinct species, see section *Fossil Elephants*, and see also MAMMOTH; MASTODON.

**African Elephant.** This species (*Elephas*, or *Loxodonta, africanus*) is confined to Africa, and until the settlement of South and East Africa during the last half of the nineteenth century it ranged over every part of the continent south of the Sahara and Nile deserts in surprising abundance. It disappeared south of the Zambezi and from near the coast as the century closed, but throughout the equatorial regions it is still numerous and is likely to remain in fair numbers, as European governments have agreed upon various laws, including a close season for females, and an export duty on the tusks, by which it is hoped to prevent rapid extermination. This species is frequently 10 feet in height, the males surpassing the average height of the Asiatic species, but the females are smaller. Both sexes have tusks—a fact which contributes to the diminution of the species, as the females are as liable as the males to be killed for the sake of their ivory. The crowns of the molar teeth exhibit a lozenge pattern of grinding surfaces, and the teeth differ in structure from those of the Indian elephant. There are but three toes on the hind feet in the East African forms, but four in those living in West Africa. The African ele-

phant has been separated into 12 or 15 subspecies, based on more or less definite characters, of which four may prove to be valid species. Some are dwarfed in size, hardly taller than a man.

This elephant was familiar to the ancient Egyptians and is believed to have been used by them in war at an early period. Those which Hannibal took with him upon his famous expedition against Rome are presumed, rather than known, to have been of this kind, but possibly were Asiatic. At any rate, African elephants were never, or very rarely, seen in Europe from the show days of Imperial Rome until about 1860, since which perhaps 100 have been taken there alive, nearly all of which soon died of disease. There seems to be no reason why the African elephant may not be tamed and educated as well as the Asiatic species. That the African savages, who frequently might capture calves, do not rear them is to be explained not only by the animal's uselessness to them, but by the impossibility, in the case of most tribes, of keeping the calf alive until it is able to quit a milk diet and live upon grass and leaves. This elephant, then, is of service to mankind only as the source of nearly all the living ivory that comes to the market.

**Asiatic Elephant.** The more familiar Indian elephant (*Elephas indicus*, or *maximus*) is prominently distinguished from the African by having a rather high, oblong head, with a concave forehead, ears hardly more than half as large, and the eyes smaller. Tusks are present only in the males and are only about half as large or heavy as African tusks; and the molar teeth are different. There are four toes on the hind feet, and the trunk terminates in the flexible finger-like prolongation already described. The height of the average male is about 9 feet and of the average female about 8 feet; but specimens exceeding 10 feet in height are not very rare. The weight is from 2 to 3 tons. They become fully grown at the age of 25, but their teeth do not show complete maturity until some years later. Several captive specimens have been known to live a century, and it seems likely that in a wild state they may sometimes reach an age of 150 years. Their distribution is somewhat less extensive than formerly, but the species ranges at the present day through the forested regions from Ceylon, the western Ghats, and Himalayan foothills eastward to Cochin-China and southward to Sumatra. They keep to the shady forests, rarely showing themselves in the open except at night or on cloudy or rainy days, for they soon feel great distress from exposure to the sun.

Elephants breed not rarely in a state of domestication, although where owned for breeding purposes, as in Siam, the studs are kept up by the capture and addition of new individuals. They are generally tamed within a few months after they are captured; some degree of severity being employed at first, which, however, as soon as the animal has begun to respect the power of man, is exchanged for kindness and gentleness of treatment. Elephants intended for domestication are captured in various ways. It was formerly common to take them in pitfalls, but in this way they were often much injured. Another method frequently practiced is by the aid of tame elephants. Male elephants chiefly are captured in this way, the decoy elephants em-

played being females, trained for the purpose. With these the hunters very cautiously approach the animal they mean to capture. Two of the females take their places, one on each side of him, while the men contrive to get beneath their bodies and to pass ropes round the legs of the intended captive. His two hind legs are fastened together by six or eight ropes, another rope keeping them tight at the intersections, and a strong cable with a running noose is attached to each hind leg. About 20 minutes are usually spent in fixing the necessary ropes, profound silence being maintained if the process goes on unobserved, or some of the other hunters distracting the attention of the elephant from those who are engaged in this work; and when at last, becoming sensible of his danger, he tries to retreat, an opportunity is soon found of tying him, by means of the long cables which trail behind him, to some tree strong enough for the purpose. His fury then becomes ungovernable, and it is not until he has thoroughly exhausted himself and begins to suffer severely from fatigue, thirst, and hunger, that the next steps are taken towards taming him.

But these huge animals are not always captured singly; whole herds are often taken at once. This is accomplished by means of an inclosure, towards which the elephants are driven by great numbers of men encircling a considerable space and contracting the circle by slow degrees. Weeks, or even months, are spent in this operation, and at last the elephants, hemmed in on every side except the mouth of the inclosure, enter it, and the gate is immediately closed. The modes of constructing the inclosure are different in different parts of the East. Tame elephants are sometimes sent into it, and the captives are in succession made fast to trees there, in a way somewhat similar to that practiced in capturing single elephants.

These elephants first became known in Europe from their employment in the wars of the East. They have been taught to cut and thrust with a kind of scimitar carried in the trunk, and it was formerly usual for them to be sent into battle covered with armor and bearing towers on their backs which contained warriors. But the principal use of the elephant in war is for carrying baggage and for dragging guns. Elephants are used in the East for carrying persons on their backs, a number being seated together in a howdah, while the driver (mahout) sits on the elephant's neck, directing it by his voice and by a small goad. Elephants have always a conspicuous place in the great processions and state displays of Eastern princes, and white elephants—albinos—are peculiarly valued. Elephants are also employed in many kinds of labor and display great sagacity in comprehending the nature of their task and adapting themselves to it.

**Fossil Elephants.** The ancestry of the elephants, or Proboscidea, can be traced back through a continuous line to a small primitive elephant living in Oligocene times in Egypt called *Palæomastodon*. This form had an elongated lower jaw, with well-developed, forward-directed incisors, small premolars and molars, with three pairs of tubercles. All the bones of *Palæomastodon* except the skull and the teeth were almost generically similar to those of the modern elephant. A clew of still earlier proboscidean evolution is found in *Mærittherium*. This animal was about the size of a tapir, and lived in Upper

Eocene and Lower Oligocene times. Although there is no doubt of relationship, yet the differences in body, skull, and dentition between this form and its successor *Palæomastodon* are great, and *Mærittherium* is proboscidean in only a very general way. In fact, it was probably semi-aquatic and lived in streams and marshes, and while unquestionably near the ancestral stem of the elephants, it was also very likely the ancestor of the modern *Sirenia*, the wholly marine manatee and dugong. They are the least specialized of the modern ungulates, for during their known history they have progressed only in respect of the development of the trunk or proboscis, the substitution of tusks for the incisor teeth, and the acquirement of an abnormal molar dentition. In the early Miocene time they are found with their proboscidean characters well developed, and the chief genera, *Gomphotherium*, *Mastodon*, and *Elephas*, which succeed each other in geologic time, present a progressive evolutionary series. In the earlier forms the bony structure of the facial region of the skull is less thickened than it is in later forms, indicating a lesser muscular attachment for a smaller proboscis. The tusks augment in size in the successive genera, and the teeth increase in complexity as to their crowns. The molar teeth of *Gomphotherium* have only 2 or 3 transverse ridges, *Mastodon* has 2 to 5, *Stegodon* has 13, and *Elephas* has 27. This complexity is due to folding of the enamel into transverse ridges, the number of folds advancing in the successive genera. The size of the molars also increases, and in the latest genus, *Elephas*, they have become so large that only two or three can be in position in the jaw at one time. The brunt of the chewing falls upon the anterior molar, and as this is worn out it is pushed forward out of the front of the jaw, and the space behind is filled by a new molar that rises from a socket at the back of the jaw. Fossil Proboscidea appear in the Miocene and Pliocene of North America and Europe and in the Pliocene of South America, but at the end of the Pleistocene they disappeared from those countries, having emigrated to Asia and Africa, where their descendants are now living. Consult: Woodward, *Outlines of Vertebrate Paleontology* (Cambridge, 1898); Bernard, *Éléments de paléontologie* (Paris, 1895); Nicholson and Lydekker, *Manual of Paleontology*, vol. ii (Edinburgh and London, 1889); Osborn, *Age of Mammals* (New York, 1910); Scott, *History of Land Mammals in the Western Hemisphere* (ib., 1913); Lull, "Evolution of the Elephant," *American Journal of Science* (New Haven, 1908); Gregory, "Adaptive Significance of the Shortening of the Elephants' Skull," *Bulletin American Museum of Natural History* (New York, 1903). See MAMMOTII; MASTODON.

**Bibliography.** Of the older sources of information, the best are the article in Jardine's *Naturalist's Library* (London, 1833-43), and Andersson's book, *The Lion and the Elephant* (ib., 1873). For the Asiatic elephant, consult: Tennent, *The Wild Elephant in Ceylon* (ib., 1867); Hornaday, *Two Years in the Jungle* (New York, 1885); Sanderson, *Wild Beasts of India* (London, 1893), the last named of which is, on the whole, the best authority on the subject; also Kipling, *Beasts and Man in India* (ib., 1891); Murry, *Les éléphants en Siam et en Cambodge* (Paris, 1900); Pollok, *Sport in British Burma* (London, 1879), and the writings of sportsmen travelers, especially D'Ewes, Forsyth,



ELEPHANTA  
TEMPLES OF ELEPHANTA, BOMBAY HARBOR, INDIA

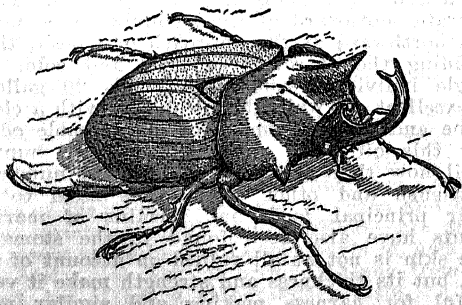




Shakespeare, Baldwin, and Barras. For the African elephant, consult: Neumann, *Elephant Hunting in East Equatorial Africa* (London, 1898); Gordon-Cumming, *Five Years of a Hunter's Life in South Africa* (New York, 1850); Harris, *Game and Wild Animals of Southern Africa* (London, 1840); Baker, *Wild Beasts and their Ways* (ib., 1890), and other books by the same writer; Holub, *Seven Years in South Africa*, translated by Frewen (ib., 1881); Selous, *A Hunter's Wanderings in Africa* (ib., 1890), and other books by Selous; Armandi, *Histoire militaire des éléphants* (Paris, 1843); Balan, *Der Elephant in Krieg und Frieden, und seine Verwendung in unsern afrikanischen Kolonien* (Hamburg, 1887); Lydekker, *The Game Animals of Africa* (London, 1908); Stigand, *Hunting the Elephant in Africa* (New York, 1913); Akeley, "Elephant Hunting in Equatorial Africa," *American Museum Journal*, vol. xii (ib., 1912).

**ELEPHANT, ORDER OF THE.** A Danish Order of uncertain origin. It dates back, according to some authorities, to Canute VI in the twelfth century, and according to others to Christian I in the second half of the fifteenth. The decoration is highly valued, because rarely conferred. The badge is a white enameled elephant, caparisoned in blue, with a red tower on its back and a negro driver. The collar consists of alternate towers and elephants. The ribbon is blue.

**EL'EPHAN'TA** (locally, *Gharapuri*). An island 4 miles in circuit, in the harbor of Bombay, East India, about 6 miles to the east of that city. It took its European name from the huge figure of an elephant, cut out of a detached rock, near its principal landing place, which, however, gradually crumbled away and was removed. It is supposed that a city flourished on the island between the third and tenth centuries. From that era date four Brahmanic temples dug out of the mountain, the roofs supported by curiously wrought pillars of various forms and magnitudes, and the walls thickly sculptured into all the forms of Hindu mythology. The largest of the excavations, or Great Cave, is nearly square, measuring 133 by 130 feet, its roof supported by six rows of six columns each. Immediately fronting its main entrance stands a bust of a three-headed deity, with a height of 18 feet and a breadth of 23, representing Siva, the trinity of creation, preservation, and destruction. The great temple is used by the Bania caste for the Sawa festivals. Pop., 1901, 480. Consult Burgess, *The Rock Temples of Elephanta* (Bombay, 1871), and Ferguson and Burgess, *The Cave Temples of India* (London, 1880).



THE ELEPHANT BEETLE.

**ELEPHANT BEETLE.** A gigantic lamellipede beetle (*Megasoma elephas*) of Central

America. Its total length is about 5 inches, two-fifths of which belongs to a strong, upturned forked horn projecting from the head. The ground color of the whole insect is black; but, with the exception of the front horn, the entire surface is thickly covered with dense, soft, upright, yellowish fur. As this fur is easily rubbed off, most specimens are partly bare. Another species, *Megasoma acteon*, of Nicaragua, is as large or larger, and its fur varies from chestnut on the horn to yellow on the elytra.

**ELEPHANT FISH, or SHARK.** A name for the chimæra (q.v.).

**EL'EPHANTIASIS** (Lat., from Gk. ἐλεφαντίασις, from ἐλέphas, *elephas*, elephant, so called because the skin becomes wrinkled like the hide of an elephant). A medical term formerly applied to any marked hypertrophy of the skin and areolar tissues, but now generally used to designate a disease accompanied by œdema and progressive hypertrophy of the cutaneous and areolar tissues. There are two diseases called by the name. One is the elephantiasis of the Greeks, which is regarded as the same as the Eastern leprosy and as the *spedalskhed* of Norway, and the chief features of which are described in the article **LEPROSY**. In this affection the size of the limbs and the state of the epidermis are comparatively slightly altered. The other is the elephantiasis of the Arabs, identical with the *Barbados leg* (q.v.) of the East and West Indies and the Levant, where it is endemic. The disease may come on slowly, without constitutional symptoms, but the acute form is attended with headache, fever, nausea, and vomiting; the leg or arm or scrotum then becomes inflamed, swollen, and tender; bullæ may form and burst, exuding serum. In a few hours or a few days the attack ends. But others follow, and the affected part becomes larger and larger, each attack leaving it greater in size. The scalp, face, or female genitals may become enlarged, as well as any other part of the body; but the leg is the most often affected. Manson, in 1883, established the fact that endemic elephantiasis is due to the presence in the lymphatics of a parasitic worm called *Filaria sanguinis hominis*. (See **FILARIA**.) The disease may be congenital. Turner, of Samoan experience, believes some cases are due to malarial infection. A condition of lymphostasis may be produced by any inflammation of the skin and subcutaneous tissues, or by removal of the lymph nodes in the groin or axilla. Thus lupus, syphilis, varicose ulcers, or other causes of recurring lymphangitis, are factors in favorable surroundings. Rest in bed, with elevation of the affected part, elastic bandaging, massage, galvanism, palliate some cases; change of climate and quinine cure a few; amputation may be necessary in some instances.

**ELEPHANTINE** (Lat., from Gk. Ἐλεφαντίνη). The Greek name of an island in the Nile, just below the First Cataract and opposite Assuan (q.v.), the ancient Syene. From very ancient times the island was a trading post whither the Nubians brought ivory and other wares for barter with the Egyptians; from this circumstance it derives its Egyptian name, 'Abu, 'ivory town,' of which the Greek name is a translation. It is called by the Arabs *Jazīrat Aswān*, 'the island of Assuan,' or simply *El-Jazīreh*, 'the island.' The whole southern end of the island is covered with rubbish heaps which have accumulated over the ruins of the ancient city.

Near by are the foundations of a small temple built by the Emperor Trajan, and a granite gateway on which are sculptures representing Alexander, son of Alexander the Great, making offerings to the gods of Elephantine and especially to the ram-headed god Knum. Farther north stood a temple built by Amenophis III and another built by Thothmes III. Both existed in a fine state of preservation until 1822, when they were demolished for the sake of the building material they contained. The most interesting relic remaining upon the island is the Nilometer (q.v.), of which a description is given by Strabo. It was restored and placed in use in 1870 by the Khedive Ismail Pasha. Consult: Champollion, *Notices descriptives* (Paris, 1844); Mariette, *Monuments of Upper Egypt* (London, 1887); Edwards, *A Thousand Miles up the Nile* (ib., 1888); Meyer, *Der Papyrusfund von Elephantine* (Leipzig, 1912).

**ELEPHANTINE PAPYRI, THE.** A collection of complete documents, and fragments of such, written on papyrus, found on the island of Elephantine near the First Cataract of the Nile or originally coming from that place. One of them was secured by the Imperial Library at Strasburg in 1898 and published by Euting in 1903. In 1904 Robert Mond purchased at Assuan a number of others which had come over from the island. These were published by Cowley and Sayce in 1906. Through the German excavations of the ancient city at the southern end of the island, in 1906-08, others were brought to light which were published by Sachau in 1907 and 1911 and by Rubensohn in 1907. Those written in Aramaic come chiefly from the archive of the Jewish military colony. Some of them are dated—the earliest apparently in 494 B.C., the latest in 404 B.C. The most important are copies of letters sent to Bagoas, the Persian Governor of Palestine, Johanan, the high priest in Jerusalem, and the sons of Sanballat in Samaria, and refer to the Yaho temple in Yeb which was destroyed by the priests of Chnub in 411 B.C. One of them deals with the observance of the Passover. Others are records of the transfer of property, marriages, and the like. There are also copies in Aramaic of the Behistun inscription (see BEHISTUN) and of the story of Ahikar, as well as numerous documents in Greek from the Ptolemaic period. The significance of the Elephantine papyri lies in the fact that they reveal the existence of a Jewish colony at the southern end of Egypt, with its own Yaho temple and its peculiar cult. The temple existed as early as 525, since it is distinctly stated that it was spared by Cambyses when he destroyed all the temples of Egypt. The colony may have come over in the time of Psammetichus I (663-609), after the concentration of the cult in Jerusalem by Josiah in 620 B.C., and may have consisted of mercenaries and their families coming from Bethel as well as from Judæan towns, since some of the deities they worshiped along with Yaho appear to be identical with some of those worshiped by the people of Bethel and Samaria. (See 2 Kings xvii. The priesthood at Elephantine does not seem to have been acquainted with the law in its complete form. (See PENTATEUCH.) Women had the right to divorce their husbands. Polytheism prevailed, though Yaho was the chief god. Consult: Euting, in *Mémoires de l'Académie des inscriptions*, vol. xi, p. 2 (Paris, 1903); Sayce and Cowley,

*Aramaic Papyri Discovered at Assuan* (London, 1906); Sachau, *Drei aramäische Papyrusurkunden aus Elephantine* (Berlin, 1907); Rubensohn, *Elephantine Papyri* (ib., 1907), the Greek papyri; Sachau, *Aramäische Papyrus und Ostraka* (Leipzig, 1911); Ungnad, *Aramäische Papyrus aus Elephantine* (1911); Ed. Meyer, *Der Papyrusfund von Elephantine* (2d ed., Leipzig, 1912); N. Schmidt, in *Journal of Biblical Literature*, vol. xxxiii, p. 1 (Boston, 1914).

**ELEPHANT MOUND.** A noted effigy mound in Grant Co., Wis., which, however, seems to have been intended for the effigy of a bear instead of an elephant. Consult *Report of Geological Survey for Wisconsin* (1873-74).

**ELEPHANT SEAL, or SEA ELEPHANT.** The largest species (*Macrorhinus leoninus*) of the hair-seal family Phocidæ, an inhabitant of the seas of the Southern Hemisphere. It is considerably larger than an elephant, being sometimes more than 20 feet in length, with a circumference of about 12 feet at the thickest part, which is at the chest, immediately behind the fore flippers; the body tapers towards the tail. The females are only one-half or one-third the bulk of the males. The color is grayish or blackish brown. The whole body is covered with very short hair, distributed in patches, giving it a spotted appearance somewhat like watered silk. The head is larger in proportion than in many seals; the eyes are very large and prominent, with eyebrows of coarse hair; the whiskers are composed of very long and coarse, spirally twisted hairs; there are no external ears; the canine teeth form massive tusks. The nose of the males is very remarkable, being prolonged into a kind of proboscis about a foot in length, which, however, seems to serve no purpose whatever except to that of an elephant's trunk, but it hangs flaccid on the face. During the breeding season the males have furious combats, the victor winning for himself a whole herd of females. When the proboscis is dilated, the voice of the sea elephant, which usually is like the lowing of an ox, is completely changed and becomes a loud and extraordinary gurgling. See Colored Plate of SEALS.

Sea elephants were to be found, at the beginning of the nineteenth century, in immense herds on the coasts of Kerguelen's Land, Juan Fernandez, South Georgia, the States Islands, South Shetland, the Falkland Islands, and the southern extremity of South America; but their numbers have been greatly reduced, and they are practically extinct in the region about Cape Horn and other easily accessible haunts. They migrate southward at the beginning of summer and northward at the approach of winter, thus avoiding the extremes of heat and cold. A single individual sometimes yields 20 gallons of excellent oil, which burns slowly, with a clear flame and without smoke or disagreeable odor. For this oil these animals have been hunted until now they are much reduced in numbers. Cuttlefish and other cephalopods seem to be their principal food, but remains of marine plants have also been found in the stomach. The skin is not at all valued on account of its fur, but its thickness and strength make it very useful for harness making and similar purposes. The flesh is black, oily, and indigestible, the tongue alone (salted) being esteemed palatable.

The second species of this genus, the northern

elephant seal (*Macrorhinus angustirostris*), was formerly common on the Pacific coast from Magdalena Bay north to San Francisco, a distance of 1000 miles. It is now on the point of extinction, being confined to the small island of Guadaloupe, off Lower California, where a herd of about 150 animals represent all the survivors of this great marine mammal. Dr. Townsend has recently studied this herd and has given a summary of knowledge of the group. Among new facts discovered is the length of the trunk in the live animal, which in a male 13 feet long measures 9 or 10 inches. This trunk is not capable of inflation, but can be retracted into heavy folds on top of the head by muscular action. The breeding season begins about March 1, and the period of gestation is 12 months. The young when born are black, and the yearlings have a call or scream unlike the voice of any other seal. The food is unknown, but in captivity live fish is preferred. A number of specimens were successfully transported to New York and lived for many months in the Aquarium.

Early descriptions of the elephant seal, in the voyages of Cook, Peron, Anson, and others, were tinged with much romance. A good modern and critical account of the animals, as observed on Kerguelen and neighboring islands, will be found in Moseley, *Notes by a Naturalist on the Challenger* (London, 1879). For the history and characteristics of the Californian species, consult Scammon, in *Fishery Industries* (United States Fish Commission, V., 1884), where further references will be found; Townsend, "The Northern Elephant Seal," in *Zoologica*, vol. i, No. 8 (New York, 1912); Murphy, *American Museum Journal*, vol. xiii (ib., 1913).

**ELEPHANT'S EAR.** The popular name of *Colocasia antiquorum esculenta*, or, as it is known to the trade, *Caladium esculentum*, a Hawaiian or Fijian plant, with very large, bright green leaves, used to give subropical effect in bedding. The rootstock is planted in good, moist soil out of doors or started in a hotbed or greenhouse and transplanted. In autumn it is stored where dampness and frost cannot reach it. In the Pacific islands the rootstock is extensively used for food, the poi of Hawaii being made from it. The plant is called taro. See Plate of EDELWEISS.

**ELEPHANT'S FOOT.** See DIOSCORIACEÆ.

**ELEPHANT SHREW.** An African shrew of the genus *Macroscelides*, so called on account of its proboscis-like nose, especially *Macroscelides typicus* of Cape Colony, and a very similar species (*Macroscelides rozeti*) of the Mediterranean border, known in Algeria as "rat-à-trompe." See JUMPING SHREW.

**ELEPHANT TORTOISE.** The giant land tortoise of the Galapagos Islands. See TORTOISE; EXTINCT ANIMALS.

**ELETZ, ve-lêts'.** See YELETZ.

**ELEUSINE, el'yu-sî'nê** (Neo-Lat., from Gk. Ἐλευσίς, *Eleusis*, a city of ancient Greece). A genus of grasses, most of which are annuals. Two of the species—*Eleusine corocana* and *Eleusine stricta*, generally called millets—are grown as grain crops in the warmer parts of Asia and in Africa. A sort of bread is made from the seed, but it has a rather bitter taste. A beer is also brewed from it. The grasses are of rapid growth and are very productive in both grain and forage. *Eleusine indica* is a well-known species in the United States, especially

in the South, where it is known as goose grass and is considered a pest. Infusions of the seeds and other parts have some reputation as domestic remedies for certain ailments. Popular names for this grass are goose grass and yard grass.

**ELEUSINIAN MYSTERIES** (trans. of Gk. Ἐλευσίνια μυστήρια, *Eleusinia mystéria*). The sacred rites with which the annual festival of Demeter was celebrated at Eleusis (q.v.). The early Eleusinian tradition of their origin is preserved in the Homeric Hymn to Demeter. According to this, the goddess, while wandering in search of Persephone, came to Eleusis in disguise and was hospitably received by King Celeus. (See CERES; PROSERPINA.) In return she directed the establishment of a temple and mystic rites in her honor and showed to Triptolemus (q.v.) and other princes the use of grain. Later these rites seem to have been largely influenced by the Orphic movement of the sixth century B.C. (see ORPHEUS), to which may be attributed the introduction of Iacchus into the triad of Demeter, Kore, and Triptolemus, who seem to have been the earlier divinities. For the nature and celebration of this worship, see MYSTERIES; for the sanctuary, see ELEUSIS.

**ELEU'SIS** (Lat., from Gk. Ἐλευσίς. A town in Attica, near the northern shore of the Gulf of Salamis, not far from the confines of Megaris. It was the chief seat of the worship of Demeter and the scene of the celebration of the Eleusinian mysteries. (See CERES; ELEUSINIAN MYSTERIES; MYSTERIES.) The town was very ancient and in early times a rival of Athens, against whose supremacy in Attica it long held out. It finally submitted on terms which left its two priestly families—the Eumolpidae and the Ceryces—in control of the sanctuary and its rites, though in later times the Athenian state controlled the revenues of the temple. The sacred buildings were destroyed by Alaric (q.v.) in 396 A.D. Until 1882 excavations on this site had been few and unremunerative; but in that year the Greek Government appropriated the site of the ancient Eleusis to the Greek Archaeological Society, which, as director, began a series of excavations which have laid bare the entire sacred precinct. The temple of the two goddesses—Demeter and Kore—has disappeared, and even its site is uncertain; but the two Propylæa erected in Roman times, the Sacred Well, where Demeter rested, lesser temples, a Bouleuterion, or Council Hall, and the great terrace on which stood the Telesterion, or Hall of Initiation, in which the mysteries were celebrated, can be plainly traced. Before the Persian War the great Hall of Initiation was a rather small building at the foot of the rocky hill which formed the ancient Acropolis. After the war this structure was enlarged by cutting back into the rock: in the time of Pericles it was still further enlarged by the erection alongside it of another hall of about the same size. (See ICTINUS.) Probably these two halls had a common upper story, for both contain many large columns which must have been needed to sustain a heavy weight. In the fourth century B.C. the architect Philon of Eleusis added a great portico (183 feet by 37½) to the common front of these halls, and in Roman times, probably under Hadrian, the two buildings were thrown into one great hall (178 feet by 170), with 42 interior columns (seven rows of six columns each), and a series of eight raised

steps around the sides. On the steps sat, it is supposed, the *Mystæ*, the initiate; below, in the centre, the ceremonies took place. Probably both lower and upper stories were used in the celebration of the mysteries. The modern name for the little Albanian village on this site is Levsina. Consult: Gardner, *New Chapters in Greek History* (London, 1892); Diehl, *Excursions in Greece* (ib., 1893); Philios, *Eleusis, ses mystères, ses ruines, et son musée* (Athens, 1896); Frazer, *Pausanias* (2d ed., London, 1913). The reports of the excavations are to be found in the *Πρακτικά* of the Greek Archaeological Society, and in the *Ἐφημερίς Ἀρχαιολογική*; they are summarized in the excellent guide-book of Philios, who directed the work for many years. For a plan of the excavations, consult Baedeker's *Handbook to Greece* (4th Eng. ed., Leipzig, 1909).

**ELEUTHERA**, ἐ-λῦ-θῆ-ρά. One of the Bahamas (q.v.), British West Indies, lying to the east of Nassau, and next to New Providence the most populous island of the whole chain (Map: West Indies, C 1). Area, 164 square miles. It is more fertile than most of its neighbors, surpassing all of them in the growth of pine-apples, oranges, and onions. Pop., 1901, 8733; 1911, 9533. The chief town is Governor's Harbor, with a fort and a good harbor.

**ELEUTHERA BARK.** See CASCARILLA.

**ELEUTHERIA.** See GREEK FESTIVALS.

**ELEUTHERUS.** Pope from 174 to 189. He is said to have received a letter from Lucius, alleged King of Britain, asking that missionaries be sent to his country to teach the Christian religion. The letter, which is not genuine, is found in the *Liber Pontificalis* and in Bede, *Historia Ecclesiastica*, vol. iii, p. 25. Consult Harnack, *Geschichte der altchristliche Litteratur* (Leipzig, 1893).

**ELEVATED RAILWAYS.** See RAILWAYS, section *Elevated Railways*.

**ELEVATION** (Lat. *elevatio*, from *elevare*, to raise, from *e*, out + *levare*, to raise, from *levis*, light; connected with Lith. *lengvous*, Gk. *ἐλαχύς*, *elachys*, Skt. *laghu*, *raghu*, light). In astronomy, the height above the horizon of an object on the celestial sphere, measured by the arc of a vertical circle passing through the object. Thus, the elevation of the equator is an arc of the meridian intercepted between the equator and the horizon of the place. The elevation of the pole is the meridian arc intercepted between the horizon and the celestial pole. It is the complement of the elevation of the equator and is always equal to the latitude of the place. The elevation of a star or any other point is similarly its height above the horizon and is a maximum when the star is on the meridian. See ALTITUDE.

In architecture the elevation is the geometrical representation of the exterior, or section of a building, which gives an appearance as if it were viewed from such a distance that no convergence of lines would be seen. Technically speaking, the elevation of a building is its vertical right-line projection. The elevation is one of the three drawings which are essential in designing any architectural structure, the others being the plan (q.v.) and the section (q.v.).

**ELEVATION AND SUBSIDENCE.** Terms applied to vertical movements of the earth's crust. The great movements of the earth's crust are ascribed to cumulative stresses in-

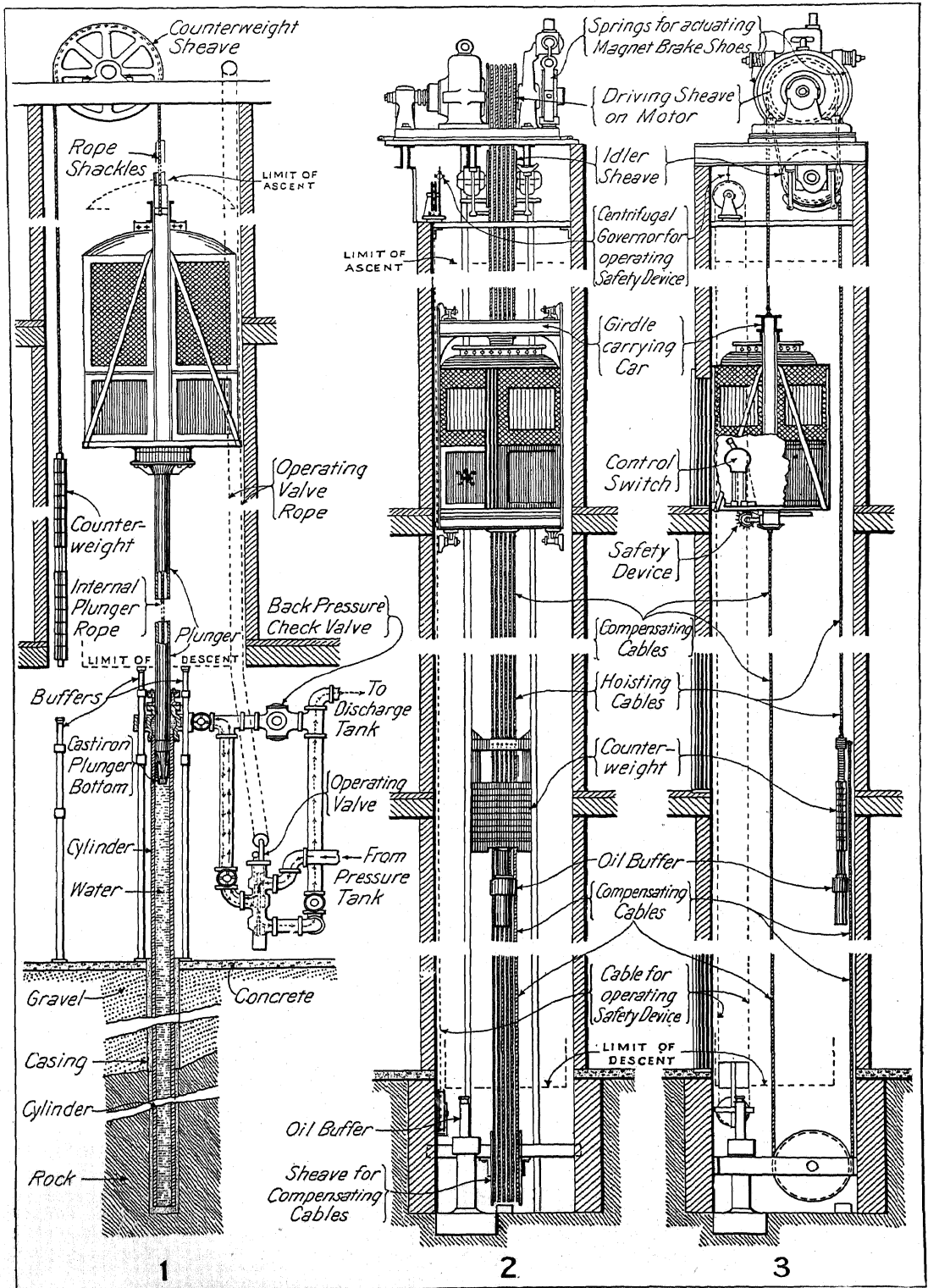
duced probably by the shifting of rock material at the surface through the agencies of weathering and erosion. While local areas may be elevated—i.e., carried farther from the centre of the earth—through the efforts of rocks to relieve themselves from great lateral stresses by bulging out, it is held by most geologists that large areas are seldom actually elevated, but that uplift is only apparent because of the subsidence of adjacent areas. In other words, it is believed that all parts of the crust are subsiding, some, however, faster than others, thus giving the impression that the adjacent areas are rising. If the sea bottom should subside, the water would flow away from the continental shores, and the continents would apparently rise, although in reality they might remain stationary. The great movements of uplift and subsidence are ordinarily considered in two great classes: (1) epeirogenic movements, or vertical movements of large areas such as continents, or large parts of continents; (2) orogenic, or mountain-making, movements—i.e., the movements which result in the folding and corrugation of the earth's crust into mountainous areas. See MOUNTAIN.

**ELEVATOR.** The modern high-speed passenger elevator is usually operated by electric or hydraulic power, and consists (1) of a rectangular car which moves up and down between guides in a shaft, or well, with doors opening into each floor, and (2) of the mechanism necessary to give this car its up and down movement, together with various devices to insure its safety and control. The passenger elevator has made possible the skyscraper and has had an extraordinary economic bearing on the design and construction of city buildings and the utilization of real estate for building purposes.

About the middle of the nineteenth century freight elevators or hoists of simple form in factories and warehouses and various crude devices in mines were utilized for vertical transportation of goods and materials, and for the most part were worked by belt-driven spur-gear machines operated by steam engines. In Europe hydraulic machinery had been extensively developed, and plunger machines, with a car mounted on the upper extremity of a vertical piston or plunger working in a hydraulic cylinder extending down into the ground, were employed for freight lifts, and also for passengers when the need for such transportation was realized. In the United States about 1870 various modifications of freight elevators were made adapting them for passenger service; and soon after a water-balance elevator was employed, where the supply of water in an iron bucket could be regulated at will and thus the motion of the car directed. By 1878 a vertical-cylinder hydraulic elevator was introduced into the Borel Building, New York City. This type of machine soon became standard, lending itself by degrees to increased range of operation and especially of height, so that the tall building of eight or more stories constructed up to the limits of height permitted by masonry walls was possible.

In the early hydraulic elevator a piston working in a vertical cylinder carried at its exterior extremity one or more pulleys, or sheaves, around which passed cables which were then bent around sheaves at the top of the elevator shaft and supported the car, running in guide rails. As water, under suitable pressure for

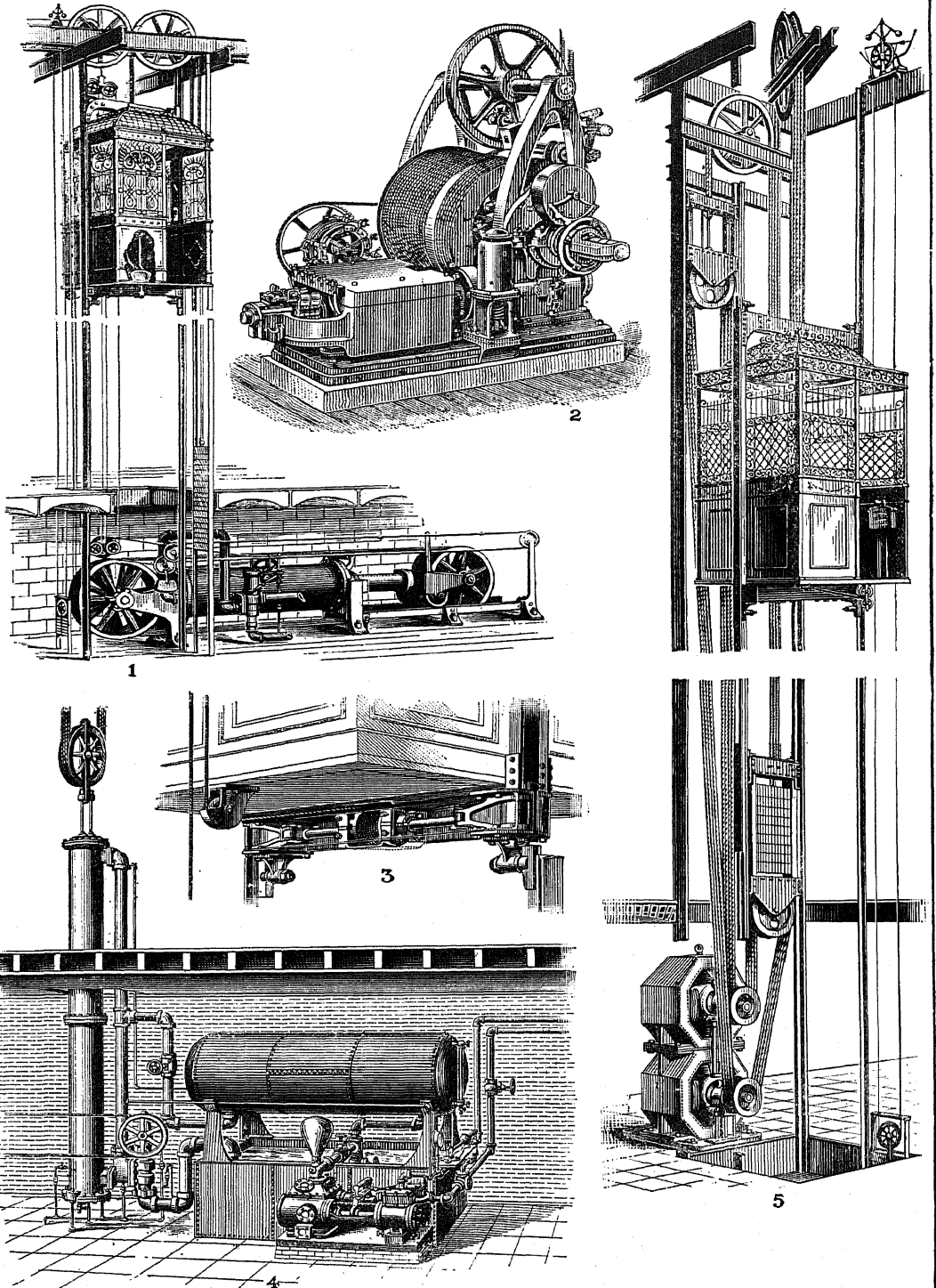
## ELEVATORS



## HIGH SPEED ELEVATORS FOR TALL BUILDINGS

1. STANDARD PLUNGER ELEVATOR, SHOWING PLUNGER AND CONTROL MECHANISM.  
2 and 3. OTIS ELECTRIC TRACTION ELEVATOR, SHOWING MOTOR, CAR, CABLES, AND GENERAL OPERATION.

# ELEVATORS



1. HYDRAULIC ELEVATOR WITH HORIZONTAL CYLINDER AND PISTON.
2. ELECTRIC MOTOR FOR SMALL ELEVATOR.
3. SAFETY CLUTCH.
4. VERTICAL CYLINDER AND PISTON FOR HYDRAULIC ELEVATOR.
5. EXPRESS ELECTRIC ELEVATOR WITH DUPLEX MOTOR.



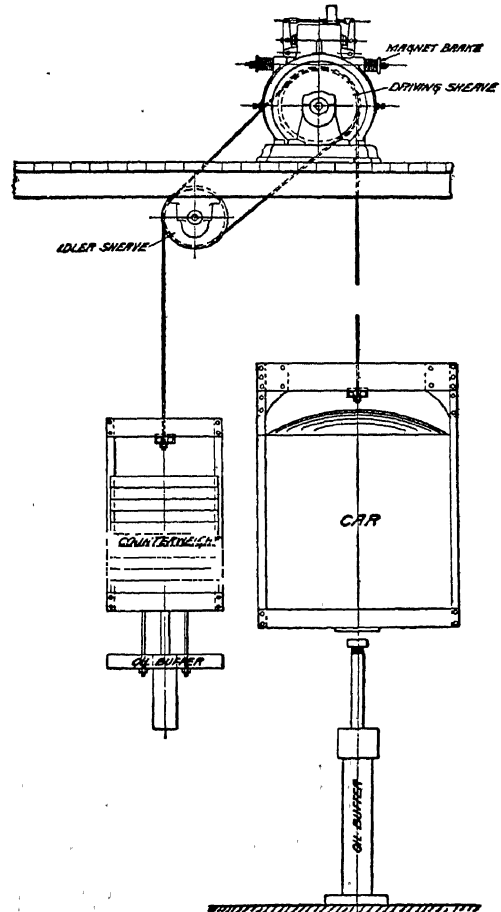
the work to be done and the size of the cylinder, was admitted to the latter, the piston was moved, and its motion, multiplied by the sheaves on the familiar principle of the block and tackle, was transmitted to the cables supporting the car. The weight of the car was counterbalanced by the moving parts of the piston and sheaves and partly by weights, and the control mechanism provided for the introduction of water on either side of the piston so that it could be moved in the desired direction. A reliable valve system regulated the quantity and pressure of the water, and the machine was soon developed to a degree where it was reliable and economical. With the opening of the skyscraper epoch, about 1893, when steel-frame construction made possible buildings of greatly increased height, the hydraulic elevator was developed to a point where it could not only satisfy the height of travel, but could reach a speed of from 400 to 800 feet per minute. The cylinder, instead of being placed vertically, as in the first and simplest types, could be mounted horizontally, usually in a basement or cellar, and a pulling or pushing motion of piston and sheaves communicated to the supporting cables, so that there was a saving of space and the possibility of using a higher gear, or ratio of travel of the piston to that of the car, by means of an increased number of moving pulleys, or sheaves. This will be appreciated when it is stated that a column of water greater in height than 32 feet, or the equivalent of the pressure of the atmosphere, could not be employed, so that for a building 240 feet in height, e.g., an eight to one gear was required.

For many years the hydraulic elevator enjoyed full supremacy and was, all things considered, an efficient and safe mechanism; but about 1893, with the growing use of electricity and its general availability for power, the electric elevator began to loom up as a formidable competitor to the hydraulic machine. Not only were increased heights of buildings to be considered, but the architects demanded, in addition, heavy and rapid traffic and economy of operation and maintenance cost. As increased capacity meant the increase of the size of the cylinders unduly for low pressures, installations were constructed where high-pressure machines working at from 100 to 800 pounds were used. Such plants met, in most cases, the conditions of service, but eventually it was found that the electric elevator was destined for universal employment.

As early as 1884 a machine worked by electric power had been invented and installed by W. Baxter, Jr., but the first installation that indicated a distinct type was in 1889, when a drum type of electric elevator was placed in a New York City building. Here the cable attached to the car, after passing over one or more sheaves, was wound around a drum, or windlass, revolved by an electric motor whose armature shaft carried a worm, or spur gear meshing into a larger gear wheel on the drum. The motor was controlled by resistances and other devices in the usual way, and the machine found wide application where light loads were involved and high speeds were not demanded. It was greatly improved and made available for various conditions of electrical supply, including both alternating and direct current, and obtained a wide range of operation from the heavy-capacity express service of the office build-

ing to the small passenger elevator of the private dwelling under the control of the passenger by means of a push button and simple automatic apparatus.

In addition to the drum type numerous other arrangements of electric motors were employed. The Sprague-Pratt multiple sheave system employed a motor where a screw connected with its armature was revolved in a traveling nut directly connected with a compound sheave by which the motion was magnified just as in the case of the hydraulic machine. The drum type was not found feasible where greater speed than about 400 feet per minute was required, as this meant too high a peripheral velocity for the drum, or windlass, around which the cable was wound, and made impossible the rapid acceleration of the car in starting from a floor and its proper retardation when stopping. The screw type did little better in the way of speed, while a system using two motors in a friction-drive arrangement attained a speed of 600 feet per minute, but had disadvantages in the way of economy and undue wear on the ropes. Consequently, with the necessity for increased



TRACTION ELEVATOR.

heights and increased speed, in order to make the twentieth and thirtieth stories of buildings accessible, more was demanded of the electric-elevator builders, as had been the case with the

designers of hydraulic machines, while at the same time simplicity and efficiency were also considerations which were figuring more than ever in the design and construction of buildings.

About 1904 the direct-traction elevator was developed by the Otis Elevator Company, and this, with modifications and improvements, has become almost standard, especially for tower buildings where a high lift is required. This machine resulted from the improvements in motor design and regulation, as its operation is based fundamentally on the control of a low-speed motor of high efficiency. Here the ropes, or cables, from the car pass over the driving sheave on the shaft of an electric motor usually placed at the top of the hatchway and then around an idler sheave, or pulley, below, and again around the driving sheave, so that each rope, having two half turns around the driving sheave, affords sufficient traction to drive the car and the counterweight, the latter being equal in weight to the car and its average load. The armature shaft is revolved when the current passes through the motor, and the car rises and the counterweight falls, or vice versa, depending upon the direction of revolution and the speed of the armature shaft, both of which, through the agency of magnetic devices, switches, and resistances, are at the command of the car operator at his lever. The speed of the car is equal to the peripheral velocity of the driving sheave over which the cables pass; and the greater the load in the car, the greater will be the adhesion between the ropes and the sheave. A brake, consisting of leather-faced shoes acting on a brake pulley under the influence of heavy helical springs, is electrically released when the car is in motion, holds the car at any point of rest, acting automatically when a safe speed is exceeded, or the car gets beyond the control of the operator, or reaches the limiting points of travel at the top and bottom of the shaft. The traction elevator has the important advantage of being economical in space, a vital consideration in a city office building, and, furthermore, its mechanism is marked by extreme simplicity.

The weight of the cable in itself is no small item, and it must be balanced by some form of chain, or flexible cable whose weight per linear foot is equal to that of the supporting cables. The traction elevator can be used for any height of rise, and successively it has been applied to such buildings as the Singer Tower, with a travel of 546 feet for the highest lift car, to the Metropolitan Life Insurance Company Tower, with a car travel of 586 feet, 5½ inches, and to the Woolworth Building, with 54 stories and a total height of 785 feet, where there is a lift of 679 feet, 10¼ inches—marking the record both for building height and for elevator installation in 1914.

Among the more efficient hydraulic machines are plunger elevators, which were developed to meet the increased heights and high speeds. Plunger elevators of limited travel had been used in Europe, but they had never acquired much vogue in America. However, with the means of drilling bore holes of considerable depth and straight in direction, an impetus was given to such installations, and elevators with a travel up to about 400 feet were installed. In the plunger elevator the plunger supporting the car is usually made of 6-inch steel tubing and is formed by lengths connected with internal

couplings. Within the plunger there is a steel rope connecting the cast-iron-bottom casting to the top, while there are four brushes that hold the bottom piece in the center of the cylinder. This cylinder in which the plunger moves up and down is also of steel tubing about 2 inches greater in diameter, and sunk in a well in the ground usually made 3 or 4 inches greater in diameter, and, where it passes through gravel or clay, lined with a retaining casing. Through a system of valves, varying in different types of machines, water under pressure is admitted to the cylinder, forcing the plunger up and out and raising the car. Permitting the water to escape from the cylinder allows the plunger to sink and the car to descend, the operator with his controlling device being able to give the necessary movement to the valves, usually through the medium of a pilot valve. The plunger elevator, like other types, must be counterbalanced, though, of course, the car and plunger will weigh more than the counterweight, as the descent is due to the action of gravitation.

The plunger elevator operates smoothly under ordinary conditions, is reliable and free from breakdowns or need of repairs, and supplies high speed for moderately high lifts. In one building in New York 21 such machines are in daily operation, seven of which are used for express service rising 368 feet to the twenty-sixth story.

Whatever the type of elevator, the fundamental considerations are ease of control and safety. The common method of control is a hand rope passing through the car, or a wheel or lever working on a system of standing ropes, or, in the case of an electric elevator, some form of switch worked by the operator. The hand rope may act directly on the main valve, or upon a pilot valve so that when the operator, when the car is at rest, pulls down on the rope, water is admitted to the hydraulic cylinder and the car rises. Grasping the rope, he causes it to move in the opposite direction, and the supply of water is cut off by the valve so that the car is stopped; while, if he moves the rope upward, the water is forced from the cylinder, and the car descends. This device was crude and ineffective, so eventually the ropes were led around pulley wheels mounted on the outside of the car, the position of which could be varied by means of a lever, and the desired strain given to the ropes, and the valve moved as desired. The lever of the electric elevator, likewise, is only a switch to admit current to the motor and cause its armature to revolve, but here provision has to be made for properly and automatically regulating the amount of current by means of magnetic appliances and resistances. In the best switches the operator has at his command several rates of speed, and, if his hand is withdrawn from the lever, it automatically returns to the stop position, and the machine comes to rest.

From the very beginning, notwithstanding the responsibility of the elevator operator, designers realized that the possibility of accident must be faced, and various safety devices have been introduced, until to-day a number of these are essential to every machine. The fall of the car, due to the failure either of the cables themselves or their fastenings, or the machine getting beyond control on its downward journey, must be guarded against, and also an uncontrolled upward trip, where, after the car has

been violently stopped, the cables might be torn from their fastenings and the car suffer a fall. At first guides of hard wood in which chisel knives would engage when a certain determined rate of speed was exceeded were employed; and, later, various forms of clamps and wedges, which worked automatically and under the influence of powerful springs, would hold the car tight in its track. Often an automatic ball governor, mounted at the top of the hatchway and revolving by ropes connected with the car, is employed, which releases the wedges when the speed is too high, while in this and other types of safety device an emergency lever can be released by the operator to set the brakes. In many electric elevators the power is also cut off by the action of the governor. Furthermore, there is an air-cushion arrangement whereby the lower part of the shaft is inclosed, so that a falling car could be brought to rest on the cushion of compressed air produced by its downward motion. Other air-cushion arrangements are employed where projections from the car engage cleats on cables which are connected with pistons and air cylinders.

In the traction elevator spring and oil-compression buffers are placed under both car and counterweight, and have proved effective in actual tests where in the highest hoistways all other safety devices have been cut out, and the machine allowed to descend uncontrolled and brought to rest effectively and without damage. The car or the counterweight accordingly strikes the piston of the buffer, which, acting on springs and oil-filled cylinders, telescopes and drives the oil from one chamber to another, thus absorbing the shock completely. An additional safety device found on many elevators consists of parallel wire ropes, extending vertically the length of the hoistway, which carry transversely cross pieces through which the ropes pass in an oblique direction, while upon the frame of the car there are cams which upon undue velocity are forced out and catch on cross pieces acting to retard the motion of the car. There are, in addition, various limiting valves and stops and various electrical devices such as indicators, telephones, door-closing and other mechanisms, all of which aim to facilitate the operation of the apparatus.

Some of the more notable elevator installations in the United States are as follows: in New York City, the Woolworth Building, with 26 elevators; the Metropolitan Life Insurance Building, with 30 elevators; the Hudson Terminal Building, with 50 elevators; the City Investing Building, 21 elevators; the Whitehall Building, with 29 elevators, and the Municipal Building, with 30 elevators. The Rothschild Building, in Chicago, has 30 elevators; the Insurance Exchange Building, 16 elevators; the Peoples' Gaslight and Coke Company Building, 14 elevators; and, in Seattle, Wash., the L. C. Smith Building has 8 elevators.

Previous to the completion of the high-tower buildings in New York City, the elevator in the Washington Monument, with a travel of 500 feet, and those of the Eiffel Tower (q.v.), with a travel of 526 feet, were noteworthy as regards height. Elevators have also been built for carrying heavy loads, such as at the Weehawken and Jersey terminus of the North Hudson County Railway, where cars held 140 people each for a lift of 148 feet; while in tunnels under the Elbe at Hamburg and under the

Clyde at Glasgow wagons are also transported from the streets to the level of the tubes.

**Escalator.** Closely allied with the elevator is the escalator, or moving stairway. This gives access from one floor or level to another by continuous action without the necessity for operators or for opening and closing doorways, etc. Escalators are employed where a large number of people must be transported, as in department stores, railway terminals, subways and elevated railway stations, and at amusement pavilions. They consist of endless chains operated usually by electric motors and supporting a series of parallel links forming a treadway, or of treads and risers which at the beginning and end of the ascent take a flat or horizontal position, but, as soon as the incline is reached, arrange themselves as treads and risers like those of an ordinary stairway. The moving platform fits closely within the floor proper and moves so slowly that it is approached without difficulty by persons of usual agility. It carries a moving hand rail to support passengers in making the ascent. At the top there may be a diagonal partition and usually an attendant to facilitate the exit on to the solid floor. The chief advantages of the escalator are its simplicity and the vast number of people that can be handled, as it serves to keep the flow of traffic always and continuously in one direction.

**Bibliography.** For an historical discussion of American passenger elevators, see Brown, "Passenger Elevators," in *Transactions of the American Society of Civil Engineers*, vol. liv, part B (1905). For general discussion of electric elevators, see *Transactions of the American Institute of Electrical Engineers* (especially vol. xix, 1902). Consult also: Baxter, *Hydraulic Elevators: Their Design, Construction, Operation, Care, and Management* (New York, 1910); Cullmer and Bauer, *Elevator Shaft Construction* (ib., 1912); Swingle, *Elevators, Hydraulic and Electric: A Complete Handbook Designed for the Use of Engineers and Operators* (Chicago, 1910); Bolton, "Operation of Passenger Elevators," in *Transactions of the American Society of Civil Engineers*, vol. lxiv (New York, 1909); id., "Operating Conditions of Passenger Elevators," *Journal of the American Society of Mechanical Engineers*, vol. xxxii (New York, 1910). The current issues of the various engineering journals furnish descriptions of the more notable elevator plants as they are installed, while the larger manufacturing companies publish considerable advertising material that has technical value also. See ACCUMULATORS.

**ELEVEN THOUSAND VIRGINS, THE.** See URSULA, SAINT.

**EL-FASHER**, el-fā'shēr. The capital of Darfur (q.v.), Egyptian Sudan, Africa, situated in a well-watered valley east of the Marrah Mountains (Map: Africa, G 3). Owing to its position at the point where some of the most important caravan routes of northeastern Africa meet, the town is of considerable commercial importance. Its permanent population is estimated at 4000.

**EL-FAYUM.** See FAYUM.

**ELF OWL.** The smallest of American owls, and perhaps the smallest of all owls—*Micropallas whitneyi*. It is little more than 6 inches in length and is reddish gray above and white below, barred irregularly with rufous brown. It dwells in and about Arizona, feeds mainly upon beetles and grasshoppers, and keeps itself

in thickets or willow copses, nesting almost invariably in deserted woodpeckers' holes made in the giant cactus. Consult: Fisher, *Hawks and Owls of the United States* (Washington, 1893); Beebe, *Owls of the Nearctic Region* (New York, 1907); and the *Auk*, vol. iii (ib., 1886).

**ELGAR**, SIR EDWARD WILLIAM (1857- ). An English musician, born at Broadheath, near Worcester, June 2, 1857. He was educated at Littleton House and studied the violin and the organ. In 1882 he became conductor of the Worcester Instrumental Society and in 1885 succeeded his father as organist at St. George's. Both of these positions he gave up in 1889 and two years later began to devote himself entirely to composition. His earlier works—*The Black Knight* (cantata, 1892); *Lux Christi* (oratorio, 1896); *Choral Suite, from the Bavarian Highlands* (1895); *Te Deum* (1897); *Caractacus* (1898); and *Orchestral Variations* (Enigma Variations) (1899)—gradually brought his name into prominence, so that for the Birmingham Festival of 1900 he was commissioned to write an oratorio, *The Dream of Gerontius*. Its first production in England (1900) aroused no great enthusiasm, but when the work was heard at the Niederrheinische Musikfest in 1902, and Richard Strauss spoke of it in terms of highest praise, it immediately was taken up again in England and met with phenomenal success. Since then Elgar has been considered the foremost of living English composers, although in none of his subsequent compositions does he rise again to the height of such genuine inspiration. His most ambitious work is an oratorio trilogy, of which two parts only are completed, *The Apostles* (1903) and *The Kingdom* (1906). Other works in the larger forms are: two symphonies (A♭, 1908, and E♭, 1911); three concert overtures, *Froissart* (1890), *Cockaigne* (1901), *In the South* (1903); and a violin concerto (1910). In 1904 Elgar was knighted. From 1905 to 1908 he was professor of music at the University of Birmingham. In 1906 he visited the United States, conducting his *Apostles* at the Cincinnati May Festival. Consult R. J. Buckley, *Sir Edward Elgar* (New York, 1905), and E. Newman, *Edward Elgar* (London, 1906).

**EL-GHOR**, ʔl-gôr', WADI. The northern part of the great depression known as El-Araba, which extends from the base of Mount Hermon to the Gulf of Akabah. The length of El-Ghor from the Sea of Galilee to the Dead Sea is about 65 miles, and its width varies from 6 to 12 miles.

**ELGIN**, ʔl'gin. A royal burgh, capital of Elginshire, or Morayshire, Scotland, on the Lossie, about 5 miles from its seaport, Lossiemouth, on the Moray Firth, and 71 miles northwest of Aberdeen (Map: Scotland, E 2). Its once magnificent cathedral, partly of Early English and partly of Middle Pointed architecture, dedicated to the Holy Trinity, begun by Bishop Andrew Moray in 1224, is now a ruin. The castle, styled of old the manor of Elgin, whose ruins, surmounted by an obelisk—erected to the memory of George, fifth and last Duke of Gordon—crown the Lady Hill, was a residence of the earls of Moray, for some time superiors of the burgh. Among the modern buildings are Gray's Hospital, Anderson's Institution, county buildings, courthouse, and asylum. Pop. (royal burgh), 1901, 8407; 1911, 8656. About 2 miles north of the town on the edge of Loch Spynie are the remains of the strongly fortified palace

of the bishops of Moray; and 6 miles to the southwest in a beautiful valley are the picturesque ruins of the Cistercian Pluscarden Priory, founded about 1230. Elgin was probably a royal burgh as early as the reign of King David I (1124-53) and had its privileges confirmed by several of his successors.

**ELGIN**, ʔl'jin. A city in Kane Co., Ill., 37 miles west by north of Chicago, on the Chicago, Milwaukee, and St. Paul and the Chicago and Northwestern railroads, and on the Fox River (Map: Illinois, H 1). The city is in a fertile agricultural region and is the centre of extensive dairy and ice industries. It has numerous manufacturing plants, which include well-known watch factories, condensed-milk works, a silver-plate factory, a shirt factory, a watchcase factory, shoe factories, machine shops, foundries, flouring mills, etc. In the city are the Elgin Academy, a Roman Catholic seminary, and the Northern Illinois Hospital for the Insane, accommodating 1800 patients. There are also two hospitals, a public library, and a system of parks. Elgin was settled in 1835, was chartered as a city in 1854, and adopted the commission form of government in 1912. The water works are owned and operated by the municipality. Pop., 1890, 17,823; 1900, 22,433; 1910, 25,976; 1914 (U. S. est.), 27,485.

**ELGIN**, ʔl'gin, THOMAS BRUCE, seventh EARL OF (1766-1841). An English diplomat. He was educated at Harrow, Westminster, St. Andrews University, and in Paris; succeeded to the earldom of Elgin and Kincardine in 1771; entered the army in 1785, and rose to the rank of major general. In 1790 he began his diplomatic career as a special envoy to the Emperor Leopold II. In 1792 he was made Minister at Brussels, and in 1795 Envoy Extraordinary at Berlin. From 1799 to 1802 he was English Ambassador to the Ottoman Porte, and it was while occupying this position that he began gathering the collection known as the Elgin Marbles (q.v.), purchased by the government for the British Museum in 1816. He was a representative peer from Scotland from 1790 to 1840.

**ELGIN**, eighth EARL OF, and **KINCARDINE**, twelfth EARL OF, JAMES BRUCE (1811-63). A British diplomat and statesman, the son of the preceding. He was born in London and was educated at Eton and Oxford. In 1841 Southampton elected him a Liberal-Conservative member of Parliament; but as his father died the same year, he succeeded to the Scottish peerage, which excluded him from the House of Commons without admitting him to the House of Lords. He began his official career at the age of 30 as Governor of Jamaica, and was Governor-General of Canada from 1847 to 1854. In Jamaica he accomplished much for the education of the negroes and the improvement of agriculture. In Canada his instructions were to carry into effect the principle of responsible government, a task which harmonized with his own political convictions. He governed by the advice of his ministers, and during his term of office responsible government was finally established and accepted. Nevertheless he met strong opposition from the Conservatives, and on the occasion of his signing the measure known as the Rebellion Losses Bill (see CANADA, *History*) his carriage was stoned and the Parliament buildings at Montreal were burned. By the Reciprocity Treaty of 1854-66 Elgin secured free trade between Canada and the United States in the

natural products of the farm, the forest, the mine, and the sea. British subjects and American citizens shared equally the coast fisheries of the provinces, the navigation of the St. Lawrence, the Canadian canals, and Lake Michigan. In 1849 he was admitted to the English peerage as first Baron Elgin. In 1857 he proceeded to China with an army, as special envoy to demand reparation for the illegal seizure of a British vessel. At Point de Galle he heard of the Indian Mutiny and without hesitation diverted his army to the assistance of Lord Canning, who with his help was enabled to hold out until reinforcements arrived. The mission to China was delayed, but eventually Lord Elgin arrived there, and the Tientsin Treaty was consummated in 1858. He also secured concessions from Japan by the Treaty of Yeddo. On his return to England he was appointed Postmaster-General and elected lord rector of Glasgow University; but as the Chinese refused to ratify their treaty, he went back to China and with a combined force of English and French captured Peking (in 1860) and this time concluded a satisfactory convention, which regulated the Chinese relations with the West down to 1890. In 1862 Lord Elgin became Viceroy of India, but in 1863 he died. Consult: Walrond (ed.), *Letters and Journals of James, Eighth Earl of Elgin* (London, 1872); Loch, *Personal Narrative of Occurrences during Lord Elgin's Second Embassy to China, 1860* (ib., 1869); Oliphant, *Narrative of the Earl of Elgin's Mission to China and Japan in the Years 1857-58-59* (New York, 1860); Stephen, *Dictionary of National Biography*, vol. vii, by Arbuthnot; Kaye, *Life of Lord Metcalfe* (London, 1858); Bourinot, *Lord Elgin* (Toronto, 1903). See also INDIA.

**ELGIN AND KINCARDINE**, VICTOR ALEXANDER BRUCE, ninth EARL OF (1849- ). An English statesman, born at Monklands, near Montreal. He succeeded his father in 1863, studied at Eton and at Balliol College, Oxford, and became, in 1886, Treasurer of the Household and First Commissioner of Public Works. From 1894 to 1899 he was Governor-General of India, in 1904 headed the Commission on the Scottish Church Crisis, and from December, 1905, to April, 1908, was Colonial Secretary in the Campbell-Bannerman ministry.

**ELGIN MARBLES**. A celebrated collection of ancient sculptures, brought from Greece by Thomas, seventh Earl of Elgin, and acquired from him for the British Museum. On his appointment as Ambassador to the Porte in 1799, Lord Elgin prepared to have drawings and casts made of the Athenian sculptures, but he was hindered until, in 1801, he secured a new firman, giving him enlarged powers and particularly forbidding any hindrance to his "taking away any pieces of stone with inscriptions or figures." After a year of toil the principal figures from the pediments of the Parthenon, 15 from its metopes and 56 slabs from the frieze, one of the so-called Caryatids from the Erechtheum, part of the frieze of the temple of Athene Nike, and numerous fragments and inscriptions, had been prepared for shipping. The war with France delayed the shipment, and it was 1812 before the last consignment arrived. Strange as it now seems, the Elgin Marbles were at first received coldly and even with severely hostile criticism, and it was not till such recognized authorities as Ennio Quirino Visconti and Canova had pointed out their historical and artis-

tic value that in 1816 a committee of the House of Commons was appointed to consider their purchase by the government. Lord Elgin had already spent £51,000, besides the loss of interest, which he estimated at £23,240. The hearing proved the legality of his title to the marbles, and the testimony of many artists confirmed the favorable judgments of the foreign critics, so that the committee reported to the House on June 7, 1816, in favor of their purchase for £35,000. The attacks upon Lord Elgin were by no means confined to the criticism of his marbles. His act in removing the marbles was denounced violently as vandalism of the most flagrant kind, and the wrath of Lord Byron found expression in Childe Harold's lament over "The walls defaced, the moldering shrines removed by British hands." There can be no doubt that in the removal of some of the metopes Elgin's workmen had wrought considerable damage to what still remained of the Parthenon, after the explosion of 1687; but a large part of the sculptures were not in place, and those that had not fallen were a mark for the wanton destructiveness of the Turkish garrison. The accounts of contemporary travelers and the present condition of what was left behind show very plainly what would have been the fate of these masterpieces had they not been rescued. The Turks had already used many fragments in the walls of the Acropolis and of private houses, and a considerable mass of marble had only recently been burned to furnish lime for mortar. Consult: Michaelis, *Der Parthenon* (Leipzig, 1871); id., *Ancient Marbles in Great Britain*, trans. by Fennell (Cambridge, 1882); *Ancient Marbles in the British Museum*, vols. vi-ix (London, 1830-39, 1842); A. H. Smith, *Catalogue of Sculpture in the Department of Greek and Roman Antiquities* (ib., 1900). For the subjects of these sculptures, see **PARTHENON**; for their place in the history of Greek art, see **GREEK ART**.

**ELGINSHIRE**, ɛl'gɪn-shɪr, **MORAYSHIRE**, or **MURRAYSHIRE**. A maritime county in the north-eastern part of Scotland (Map: Scotland, E 2). Area, 476¾ square miles. In the south the high and rugged Monadhliadh of Inverness-shire divide the basin of the Spey and Findhorn. The soil is very fertile in the north, and the county is noted for its advanced state of agriculture. It has profitable salmon and salt-water fisheries. Its principal industry is the manufacture of whisky. Chief town, Elgin. Pop., 1801, 27,760; 1851, 39,000; 1901, 44,800; 1911, 43,427.

**EL GRECO**. See **GRECO**, EL.

**EL-HASA**, ɛl-hä'zä. A tributary state of Turkey, included in the Turkish Vilayet of Basra, on the east coast of Arabia (Map: Turkey in Asia, F 5). The region is noted for its excessive aridity. Its surface is generally flat and sandy, with here and there an oasis. The inhabitants, who number about 175,000, are chiefly engaged in raising camels and in cultivating dates, indigo, cotton, and wheat. Capital, El-Hofuf (q.v.). The territory has been a dependency of the Ottoman Empire since 1819.

**EL-HOFUF** ɛl-hô-fuuf, or **HOFHUF**. The capital of El-Hasa, Arabia, near the Persian Gulf (Map: Turkey in Asia, F 6). Its seaport is El-Ajr. It has an estimated population of over 25,000.

**ELHORST**, ɛl'hɔrst, **HENDRIK JAN** (1861- ). A Dutch Old Testament scholar, born in

Wisch, Guelderland, and educated at the University of Amsterdam. He entered the Mennonite ministry and held . . . in Insuum, Friesland (1887), Arnhem ( . . . ), Hague (1898), and Haarlem (1900), where he was a prominent member of Teyler's Foundation for the study of theology, etc., and in 1906 became professor of Hebrew language, antiquities, and literature in the University of Amsterdam. In 1911 he received the degree of D.D. from the University of Aberdeen. He published critical commentaries (with translations) on Micah (1891) and Amos (1899), and *Israel in Het lichte der jongste onderzoekingen* (1906).

**ELI** (Heb. *'Eli*, elevation). A priest and, according to the biblical account, also one of the judges of the Hebrew confederacy. He traced his family back to Ithamar, the youngest son of Aaron (cf. 1 Chron. xxiv. 3 with 2 Sam. viii. 17 and 1 Kings ii. 27), and officiated in the temple at Shiloh. Eli was also judge over Israel for 40 years (1 Sam. iv. 18; the Greek version has "20 years"). The boy Samuel was brought up in the temple under his care (1 Sam. ii. 11, 21). Eli's two sons, Hophni and Phinehas, were guilty of serious misconduct (1 Sam. ii. 12-17, 22), for which Eli reproved but did not punish them (1 Sam. ii. 23-25). For this neglect Yahwe censured him, telling him, first through "a man of God" (1 Sam. ii. 27-36) and then through the youthful Samuel (1 Sam. iii. 11-18), that his house should be punished for its wickedness. This promise was executed in the battle of Ebenezer (1 Sam. iv. 1, 10-11), when Hophni and Phinehas were slain and the ark of God taken by the Philistines. When Eli, then 98 years old, heard the news, he fell backward from his seat and died (1 Sam. iv. 15, 18). The priesthood finally passed out of the house of Ithamar in the days of Solomon (1 Kings ii. 27).

**ELIA**. See LAMB, CHARLES.

**ELIAS**, APOCALYPSE OF. See APOCRYPHA, section *Old Testament*.

**ELÍAS**, á-lé'as, DOMINGO (1805-67). A Peruvian statesman. He was born at Ica, Peru, and was educated at a college at Madrid and in France. Returning to Peru in 1825, he became an enthusiastic supporter of liberal and progressive principles. One of his most noteworthy achievements was the introduction of the planting of cotton . . . scale into the new republic. The . . . of the vine and the introduction of Chinese labor were also due to him. He established at Lima the College of Our Lady of Guadalupe and several other educational institutions and afterward played a conspicuous part as a soldier and legislator.

**ELIAS**, é-lí'as, NEX (1844-97). An English explorer and diplomat, born at Widmore (Kent). In 1865 he became a fellow of the Royal Geographical Society, in 1866 went to Shanghai, China, as the employee of a mercantile firm, and in 1868 set out upon an expedition for the examination of the new and old courses of the Hoang-ho. In 1872 he undertook a difficult journey of 4800 miles across the Gobi Desert to Nizhni Novgorod. The results of this expedition were described by him in a paper written for the Royal Geographical Society, from which he received a gold medal. He was appointed extra attaché to the Foreign Office at Calcutta in 1874, shortly afterward assistant to the British resident at Mandalay, and in 1877 an attaché to the mission at Kashgar. Later he was variously detailed for special duty, and from 1891 until

his retirement in 1896 was Consul General for Khorasan and Seistan. In 1885 he began a survey from the Chinese boundary to Ishkashim (a distance of 600 miles). During this expedition he contributed much to the determination of the geography of the Pamirs and decided the Panja River to be the upper course of the Oxus, or Amu-Daria. His writings include chiefly papers in the journals of the Royal Asiatic Society and the Royal Geographical Society, and an English version of the *Tarikh-i-Rashidi* of Mirza Haidar (with E. D. Ross, 1897).

**ELIAS**, RABBI. See WILNA, RABBI ELIAS.

**ELIAS LEVITA**. See LEVITA.

**ÉLIE DE BEAUMONT**, á-lé' de bó'môn', JEAN BAPTISTE ARMAND LOUIS LÉONCE (1798-1874). A French geologist. He was born at Canon (Calvados) and educated at the Ecole Polytechnique and the Ecole des Mines in Paris. In 1823 he accompanied Dufrenoy and De Villiers on a scientific tour of England and Scotland. Many of the scientific observations made during this journey were embodied in the volume *Voyage métallurgique en Angleterre* (1827), of which Elie de Beaumont and Dufrenoy were joint authors. Elie de Beaumont was one of the founders of the geological survey of France and rendered valuable services in the publication of maps and descriptions of the geology of that country. He also made an exhaustive study of mountains, and it is in this connection, perhaps, that his name is best known to scientists. While his theory that mountain ranges of the same orientation are contemporaneous and formed by the same causes did not meet with general acceptance, it was the means of attracting increased interest to this branch of geology. In its support he also collected and published much new information. In 1829 he was made professor of geology at the Ecole des Mines, and in 1835 he became a member of the Academy of Sciences. On the death of Arago (1853) he was selected to serve as perpetual secretary of the Academy. He was elected to membership in many foreign scientific societies, including the Academy of Berlin and the Royal Society of London. In 1852 he became, by decree, a Senator of France. His best-known works are *Leçons de géologie pratique* (1847) and *Notice sur le système des montagnes* (1852).

**ELIGIUS**, é-lí'í-ús, SAINT, also called ELOI, or ELOYSIUS (c.588-659). An artist and bishop of early France, the patron saint of goldsmiths. He was born near Limoges, about 588. He learned the goldsmith's trade, was introduced at the court of Clotaire II, and became Master of the Mint under that King and his son and successor, Dagobert I (628-38). Both kings trusted him with important works, among them a chair of gold. He also made shrines, ornaments for tombs, sarcophagi, etc. Eligius was a faithful and conscientious servant of his masters and showed a strong inclination to piety. He gave liberally to the poor, founded religious houses, and was active against heretics. In time he became a priest, and in 640 was made Bishop of Noyon. After settling the affairs of his diocese in order, he made a missionary visit to the heathen of Flanders and Zeeland. His life and works are in Migne, *Patrologia Latina*, lxxxvii.

**ELIHU**, é-lí'hū or é-lí'hū. One of the speakers in the Book of Job. In the prose introduction to his four speeches, which occupy chaps. xxxii-xxxvii, he is said to be a son of Barachel,



the Buzite, of the family of Ram. The fact that his name does not occur among the friends of Job in the old prose story preserved as a prologue and an epilogue to the work indicates that the section ascribed to Elihu is a later supplement to the dialogues. This conclusion is amply sustained by the internal evidence. Though the author appears with an air of superior knowledge, as if a new solution of the riddle were to come from his lips, his arguments are precisely the same that have already been urged by the three friends. Even his language is reminiscent of their speeches. The most incisive and sympathetic criticism cannot make of the chapters a real contribution to the discussion or a work worthy of the pen of that inspired poet to whom we owe the dialogues. Only in his angelology does the author show a certain originality; but his views on that subject have no bearing on the great arguments of the book and clearly betray his later date. The weight of scholarly opinion is strongly against the authenticity of these speeches. Such critics as have recently attempted their rehabilitation have been largely influenced by the manifest possibility of greatly improving the text by conjectural emendation. Consult: Duhm, *Das Buch Hiob* (Freiburg, 1897); Budde, *Das Buch Hiob* (Göttingen, 1896); Cheyne, "Job," in *Encyclopaedia Biblica* (London, 1899); Peake, *Job* (1904); Gibson, *Book of Job* (1905); Barton, *Job* (1911); Schmidt, *Messages of the Poets* (1911); Strahan, *Book of Job* (1913).

**ELIJAH** (Heb. *Eliyāhū*, Yahwe is God; in the Greek form, occurring in the New Testament, *Ἠλίας*, *Elias*). An Israelitish prophet. The story of Elijah is elaborately told, chiefly in connection with the reign of Ahab (1 Kings xvii-xxi), but also in connection with that of Ahab's successor, Ahaziah (2 Kings i-ii). This narrative is probably based, as is also the story of Elisha, on separate literary sources which lay before the compiler of Kings, and which contained a series of stories with legendary embellishments of the earlier prophets and seers that have been rather skillfully woven into the narrative of the kings of Israel and Judah. Elijah, whose home appears to have been in Gilead (though the reading 1 Kings xvii. 1 is not certain), may be designated as a devotee of Yahwe, who resented the . . . of the Yahwe cult with the worsh . . . anitish Baalim (see BAAL), and whose fierce opposition was brought to a climax by Ahab's readiness, for political reasons, to introduce the cult of the Tyrian Baal into the domain of Israel. He represents the opposition to all Baal worship brought to a focus through the step taken by Ahab in building a temple to Baal of Tyre as a symbol of the alliance between Israel and the Tyrian kingdom that was brought about by the marriage of Ahab with Jezebel.

Elijah is rather abruptly introduced by the writer as the uncompromising opponent of Ahab, to whom he declares that no rain or dew is to fall save at the prophet's declaration. A famine ensues, during which time Elijah is miraculously fed by ravens. The famine increases, and at last Ahab is forced to yield and give his consent to a contest between Elijah and the prophets of Baal. The latter call upon Baal to send down the rain, but in vain. When Elijah, however, appeals to Yahwe, lightning comes to consume the bullock which the prophet had placed on an altar soaked with water. By

the order of Elijah the prophets of Baal are slain at the brook Kishon, and rain is sent by Yahwe. Such is the general character of the Elijah stories, all intended to illustrate the superiority of Yahwe over other gods. Ahab is represented as again led astray by Jezebel, who continues the opposition to Elijah. At times the latter is portrayed nigh unto despair; but he is encouraged by Yahwe, who appears to him in the "rustling of the breezes," and while threatening destruction to Israel promises escape to those who do not bow the knee to Baal. Even though the story of his life as given in the Bible be considered as having legendary and mythical features, we see in Elijah one of the most striking figures in Hebrew history—one whose attitude foreshadows important changes in the religious life of the people. He shares, however, many of the characteristics of the old-time seer, whose chief function it was to give oracles and to control the moods of the deity in whose service he stood. He wears a primitive dress—a robe of goat's or camel's hair with a leathern girdle. He is accompanied often by a guild of prophets, though at times he mysteriously disappears and seeks the solitude of the wilderness. So, during the great famine, it is in the wilderness that ravens bring him bread and meat every morning and evening, and it is again in a solitary spot of the wilderness beyond Beersheba that his strength is miraculously restored to him through a cake and a cruse of water that suddenly appear and which sustain him for 40 days. He is not connected with any sanctuary and holds no position at the court. His appearance is as sudden as his disappearance. His courage is unbounded, for those parts of the narrative which picture him denouncing King Ahab probably rest upon historical ground, even though details have been added to color the dramatic situation. (See AHAB; JEZEBEL.) The transfiguration of Elijah, which takes place in the presence of his disciple Elisha (2 Kings ii. 11), may be a strange touch illustrating the admixture of myth and legend. A fiery chariot with fiery steeds descends from above, and Elijah rides in the storm to heaven. An old storm myth, in which the rolling of the clouds is taken as portraying the storm god himself riding in his chariot, may have been incorporated into the story of the old prophet. The mantle of Elijah falls from him as he ascends, and it is picked up by Elisha. In this way the indication is given that Elisha is to continue the work of Elijah. See ELISHA. Consult: The Commentaries on the Books of Kings by Klostermann, Benzinger, Kittel, Burney, Skinner, Barnes, Wellhausen, *Prolegomena* (6th ed., 1905); id., *Israelitische und jüdische Geschichte* (7th ed., 1914); Gunkel, *Elias und Baal* (1906); Erbt, *Elias, Elisa, Jona* (1907).

**ELIJAH**. An oratorio by Mendelssohn (q.v.), first performed at Birmingham, England, Aug. 26, 1846; in the United States Feb. 13, 1848 (Boston).

**ELIJAH OF WILNA**. See WILNA, RABBI ELIAS.

**ELIMINANT**. See DETERMINANTS; ELIMINATION.

**ELIMINATION** (from Lat. *eliminare*, to turn out of doors, from *ex*, out + *limen*, threshold). A process by which, from a number of statements concerning several quantities, a separate statement concerning each is obtained. In a larger sense it means the setting aside of

all extraneous considerations—of everything not essential to the result. In algebra elimination is the operation which causes a quantity or a letter common to two or more equations to disappear, thus reducing a given system of equations to one of a less number of unknowns. If three unknown quantities, e.g., are to be found from three independent equations, the first step is to form from the three given equations two new ones, so as to eliminate one of the unknown quantities. From these two equations another of the unknown quantities is eliminated, giving one equation of one unknown quantity, the value of which is then found. In solving simultaneous linear equations, the simplest methods are those of addition (or subtraction) and comparison (or substitution). In the former method the coefficients of the unknown to be eliminated are made alike, or alike except in sign, and the two equations subtracted or added member to member, thus causing the unknown to disappear. In the latter case each equation is solved for the chosen unknown in terms of the other unknowns, and these expressions for the same quantity equated one to another. In complicated equations elimination becomes difficult and often impossible. Two methods for eliminating a single unknown from two consistent equations of any degree deserve special mention. The first, known as Sylvester's dialytic method, will best be understood from an example:

To eliminate  $x$  from the equations

$$\begin{aligned} a_3x^3 + a_2x^2 + a_1x + a_0 &= 0 \\ b_2x^2 + b_1x + b_0 &= 0 \end{aligned}$$

Multiplying the members of the first equation by  $x$ , and those of the second by  $x$  and  $x^2$  successively, we have

$$\begin{aligned} a_3x^3 + a_2x^2 + a_1x + a_0 &= 0 \\ a_3x^4 + a_2x^3 + a_1x^2 + a_0x &= 0 \\ &\quad b_2x^2 + b_1x + b_0 = 0 \\ &\quad b_2x^3 + b_1x^2 + b_0x = 0 \\ b_2x^4 + b_1x^3 + b_0x^2 &= 0 \end{aligned}$$

The eliminant of these five equations in  $x^4, x^3, x^2, x$  is

$$\begin{vmatrix} 0 & a_3 & a_2 & a_1 & a_0 \\ a_3 & a_2 & a_1 & a_0 & 0 \\ 0 & 0 & b_2 & b_1 & b_0 \\ 0 & b_2 & b_1 & b_0 & 0 \\ b_2 & b_1 & b_0 & 0 & 0 \end{vmatrix} = 0$$

(See DETERMINANTS.)

This method may be applied to certain systems of more than two equations. Euler also suggested an ingenious method, as follows:

Given the equations

$$\begin{aligned} F(x) &= a_3x^3 + a_2x^2 + a_1x + a_0 = 0 \\ f(x) &= b_2x^2 + b_1x + b_0 = 0 \end{aligned}$$

These equations, being consistent, have a common root,  $r$ . Hence,

$$\begin{aligned} \frac{F(x)}{x-r} &= a_2x^2 + a_1x + a_0 \\ \frac{f(x)}{x-r} &= \beta_1x + \beta_0 \end{aligned}$$

Dividing these equations member for member and equating the coefficients of like powers of  $x$ , five equations are found, whose eliminant is the same as that given above. Consult: Muir, *Theory of Determinants* (London, 1890); Burnside and Panton, *Theory of Equations* (Dublin, 1901); Dickson, *Introduction to the*

*Theory of Algebraic Equations* (New York, 1903); Young, *Monographs on Modern Mathematics* (ib., 1911); Fourier, *Die Auflösung der bestimmten Gleichungen* (Ger. ed. by Louvy, Leipzig, 1902).

**ELÍO**, á-lé-ó, FRANCISCO JAVIER (1767-1822). A Spanish general. He was born at Pamplona and was educated at the Military Academy of Puerto Santa María. He fought with distinction in the wars in northern Africa and in the campaign with France (1793-1795) and on Sept. 9, 1807, recaptured Montevideo from the English and became governor of the city. Recalled to Spain in 1812, he became commander of the army of Catalonia and Valencia, and was afterward (1813) appointed Governor and captain general of Murcia and of Valencia. He had scarcely begun his service when the Count of Cervelló, the oldest general in Valencia, received an order from the King for the arrest and execution of Elío within 24 hours. Despite the fact that the order was signed by the ministers, it was so incredibly unjust that the Count of Cervelló, in agreement with three other generals, decided to postpone carrying out the instructions. The next day Elío received an autograph letter from the King so eulogistic that there could be no doubt that the order was a forgery. Elío believed it to be the work of the secret societies among the Liberals, and he became their uncompromising enemy. After peace and order, he did everything to promote the interests of the province of Valencia and Murcia, aiding labor, arts, beautifying Valencia City, irrigating works and otherwise improving agriculture, and introducing vaccination. Despite all this, as a consequence of his opposition to the Liberals, the storm burst upon him in 1822, and he was captured after the reestablishment of the constitution of 1812 and imprisoned by the insurgents in the citadel, where, upon an attempt of the soldiery to effect his release, he was brought before a popular tribunal, sentenced to death, and executed. He died protesting his fidelity to his sovereign, who later decreed to his widow and children all the emoluments of the dead general and created his oldest son Marqués de la Lealtad.

**ELIOCROCA**. See LORCA.

**ELIOT**, SIR CHARLES NORTON EDGEcombe (1864- ). An English Orientalist and educator. He was educated at Cheltenham and at Balliol College, Oxford, and became a fellow of Trinity College, Oxford. In 1888-1904 he was in the British diplomatic service—at St. Petersburg, Constantinople, Morocco, Bulgaria, Serbia, Washington (1898, Secretary of Embassy), Samoa, and (1900-04) Zanzibar, and the East African protectorate. In 1905-12 he was vice chancellor of the University of Sheffield, and in 1912 he was chosen to be the first principal of the University of Hongkong. He wrote papers on marine zoölogy and published: *A Finnish Grammar* (1890); *Turkey in Europe* (1900); *The East Africa Protectorate* (1905); *Letters from the Far East* (1907).

**ELIOT**, CHARLES WILLIAM (1834- ). An American educator of note. He was born in Boston, Mass., graduated at Harvard College in 1853, was tutor in mathematics there from 1854 to 1858, and was assistant professor of mathematics and chemistry in the Lawrence Scientific School of Harvard from 1858 to 1863.

The years 1863-65 he passed in Europe in the study of chemistry and in the investigation of educational methods, and from 1865 to 1869 he held the chair of analytical chemistry in the Massachusetts Institute of Technology, then newly founded. In 1869 he became the twenty-second president of Harvard. His accession marked an epoch in the history of the institution. He forthwith began a remodeling of the curriculum on a liberal basis, broadly patterned after that of European universities. The elective system as known to American education was devised by him. His aim was to make this system, as conducted at Harvard, not less strict in its requirements, but more inclusive in its privileges, than that traditionally associated with the American college. He became an acknowledged authority on higher education, and his annual reports have been regarded as important in the study of problems connected with the subject. He also became widely known as an occasional speaker and a writer on educational and other topics. He retired from the presidency of Harvard University in 1909 and thereafter devoted himself to the cause of international peace. He was made an officer of the Legion of Honor and a grand officer of the Crown of Italy, received the Imperial Order of the Rising Sun (first class) and the Royal Prussian Order of the Crown (first class) in 1909, and was elected a corresponding member of the Academy of Moral and Political Sciences of the French Institute, a fellow of the American Academy of Arts and Sciences, and honorary president of the National Conservation Association. In 1913 he declined the ambassadorship to Great Britain, offered him by President Wilson. In 1914-15 he was president of the American Association for the Advancement of Science. His publications include: *The Compendious Manual of Qualitative Chemical Analysis* (with F. H. Storer, 1869; 16th ed., as revised by Nichols and re-revised by Lindsay, 1892); *The Working of the American Democracy*, an address (1888); *American Contributions to Civilization, and Other Essays* (1897); *Educational Reform: Essays and Addresses* (1898); *More Money for the Public Schools* (1903); *John Gilley* (1904); *Four American Leaders* (1906); *The Durable satisfactions of Life* (1910).

**ELIOT, GEORGE** (1819-80). The pseudonym of Mary Ann Evans, generally recognized as the foremost of English women novelists. The Evans family, originally Welsh, was of sturdy, middle-class stock. Her grandfather, George Evans, was a carpenter and builder in Derbyshire. Her father, Robert, bred to the same business, seems to have been a man of uncommon vigor, both physical and mental, with an inborn knowledge of valuations that won him high repute as a land agent. In this capacity he was engaged by Mr. Francis Newdigate to take charge of his Arbury estate in Warwickshire, and here, at South Farm, George Eliot, the third child by his second wife, was born, Nov. 22, 1819, in the heart of that stolid farming life of the English midlands which she was later to mirror back so faithfully. The details of the author's early years, her companionships, her physical surroundings, and mental growth, might easily be filled in from her writings, since few novelists have drawn so freely from their own personal and intimate experiences. The chief landmarks of the neighborhood can readily be identified in

her earlier volumes. Arbury Court is the "Cheverel Manor" of *Mr. Gilfil's Love Story*; the town of Nuneaton is the "Milby" of *Janet's Repentance*; and its suburb, Chilvers Coton, figures as "Shepperton" in *Amos Barton*. Her family are admittedly the prototypes of the Dodsons in *The Mill on the Floss*; there is much of her brother Isaac in the Tom Tulliver of the same novel; and critics have traced a resemblance between her father and Caleb Garth in *Middlemarch*, and have identified her mother with the inimitable Mrs. Poyser in *Adam Bede*. These analogies must not be pushed too far, but that George Eliot's own personality is set forth in the character of Maggie Tulliver there can be no doubt. As a piece of unsparing self-revelation, a searching analysis of a child's moods and emotions, it can hardly be equaled. In Maggie she has drawn herself as an impetuous, proud, and highly sensitive child, with an instinct for passionate devotion to some one person—an instinct which throughout her life was vital in her. Like Maggie, too, she was not a precocious child, preferring play to study, and with difficulty learning to read. It must be admitted that at this time her stock of books was not altogether inspiring, among them being *Aesop's Fables*, *Joe Miller's Jest-Book*, and Defoe's *History of the Devil*; but she also read *The Pilgrim's Progress*, *Rasselas*, and *Waverley* and other novels of Scott. The local schools of Nuneaton supplied her early needs, and increased in her the strong religious and evangelical bent which characterized her youth, but the important formative years from 12 to 15 were passed at a school in Coventry. Her mother's death in 1836, devolving upon her much of the care of the farm, interrupted her studies temporarily. Yet she soon found means to gratify her awakened thirst for knowledge, studying among other subjects Italian, German, Greek, and Latin, though so assiduously and unsystematically that at the age of 19 she could describe her mind as "an assemblage of disjointed specimens of history, ancient and modern, scraps of poetry picked up from Shakespeare, Cowper, Wordsworth, and Milton, morsels of Addison and Bacon, Latin verbs, geometry, entomology, and chemistry."

When George Eliot was 21, her father's retirement from business and his removal to Coventry brought a momentous change into her life. Hitherto she had stifled in the intellectual isolation of dull, monotonous farm life. Henceforth her mental horizon was destined to grow steadily broader. At Coventry she met George Bray, the author of an *Enquiry Concerning the Origin of Christianity*, which profoundly affected her religious views. In the first enthusiasm of her new convictions she ceased to attend church—an attitude of open aggressiveness which almost led to a serious breach with her father. But friends effected a reconciliation, she agreed to attend services once more, and for the remainder of her life maintained a consistent tolerance towards the sincere beliefs of others, even when she regarded them as mere superstitions. It was through George Bray that she was led to undertake her first serious literary work, a translation, which a friend of Bray's had begun and discontinued, from the German of Strauss's *Life of Jesus*. The task absorbed her for two years, though it seems to have bored her sadly towards the end, and at times she revolted from her author's atti-

tude. In 1846, when her translation appeared, she declared herself "Strauss-sick"—it had made her ill to dissect the beautiful story of the crucifixion.

George Eliot's life as an author, from the appearance of the Strauss translation to the day of her death, may conveniently be divided into three periods—the first extending down to her union with Mr. Lewes in 1853; the second and third covering respectively her earlier and later novels, sharply divided by the production of *Romola* (1863). Her father's death in 1849 leaving her free, she made her first visit to the Continent, spending eight months in Geneva. A review of Mackay's *Progress of the Intellect*, which appeared in the *Westminster Review* (January, 1851) soon after her return, resulted in her appointment as assistant editor of that review, as reorganized by Mr. Chapman. Through the *Review* she came in contact with many of the chief literary lights of the period, with Froude and J. S. Mill, Theodore Parker and Harriet Martineau. But "her brightest spot is the deliciously calm new friendship that Herbert Spencer gives her," and it was through the latter that she met George Henry Lewes, with whom, in July, 1854, she formed a union which he and she regarded as matrimony.

To what extent an open disregard for accepted conventions may be excused by an honest belief in the integrity of one's own purpose can probably never be decided. It is certain that George Eliot felt deeply the censure of relatives and friends, yet at the same time she was firm in her conviction that her acts were justified. A legal marriage was impossible, since Lewes already had a wife living, from whom he was separated under circumstances that precluded the possibility of a divorce. But that both Miss Evans and Lewes regarded their union as possessed of all the solemn force of a lifelong tie there can be no doubt. Equally certain is it that whatever fame George Eliot achieved as a novelist, she owed in the first instance to the encouragement and unswerving faith of Lewes. Whether his influence in the working out of specific details of plot was always for the best may be questioned; but it is more than likely that without the stimulus of his belief in her powers her first novel would never have been written.

*The Sad Fortunes of the Rev. Amos Barton*, her first essay at fiction, appeared in *Blackwood's Magazine* in 1857 and was followed by *Mr. Gilfil's Love Story* and *Janet's Repentance*, afterward united in a single volume, *Scenes of Clerical Life* (1858). The volume evoked warm praise from many sources, notably from Thackeray, who thought the author was a man.

The personal side of George Eliot's life during the years following her discovery of her real talents may be summed up briefly. They were years of strenuous work, handicapped by a frail physique and brightened by pleasant summers in Germany, a few weeks in Florence in 1860 and 1861, gathering material for *Romola*, and a trip to Spain in 1867, in search of local color for *The Spanish Gypsy*. In November, 1878, the death of Mr. Lewes came as a crushing blow, but she found congenial occupation in planning and founding a studentship in his memory. Mr. John Walter Cross, who had long been on intimate terms with the Leweses, now became a constant visitor, and in the spring of 1880 George Eliot consented to marry him,

the marriage taking place on May 6. At this period she could write, "Deep down there is a river of sadness, but this must always be with those who have lived long—and I am able to enjoy my newly reopened life." She was not destined to enjoy it long. A serious illness in the autumn, followed by a relapse early in December, exhausted her vitality, and she died on the 22d of that month.

Which of her novels represents the culmination of George Eliot's powers is likely to remain a subject of controversy. Some critics will share with Mr. Oscar Browning the belief that her genius was of steady and uniform growth, reaching its greatest height in her last work, *Daniel Deronda* (1876). Others, like Sir Leslie Stephen, will continue to believe that nothing she produced subsequent to *Silas Marner* (1861) equals the volumes that preceded it. There will always be a select few who will look upon that remarkable *tour de force*, *Romola* (1863), as the turning point in her career; while the volume which has steadily enjoyed the widest popularity with the general reader is *Adam Bede* (1859). This last-mentioned story was suggested by an anecdote related to the author by an aunt, a Methodist preacher, who once passed a night in prayer with a girl condemned for child murder. The aunt became the Dinah Morris of the story and, at the suggestion of Lewes, was made the centre of interest from first to last—a change which more than one critic has censured. The lasting merit of this book, as of *The Mill on the Floss* (1860), which followed it, is less in the plot than in the marvelous alchemy which transforms the narrow, humdrum lives of dull-witted farming folk into vital pictures full of sympathetic appeal. *The Mill on the Floss* is sometimes pronounced an ill-proportioned piece of work, and the author herself admitted that her memories of childhood days lured her into unduly amplifying the earlier part. Yet it is the commonplace and wholly natural chatter of the Dodsons and Gleggs and Tullivers, the childish joys and sorrows of Maggie, her quarrels with Tom, her father's sympathy with his "little wench," that are remembered long after the later chapters of error and renunciation have grown dim. *Romola* was George Eliot's most ambitious work. It was an attempt to work out some deeply interesting ethical problems, not in the familiar atmosphere of her English midlands, but in the Florence of Savonarola and the Renaissance. The task demanded an amount of special research that was exhausting. She herself said of it that she began it as a young woman and finished it as an old one. It has sometimes been called the greatest historical novel ever written; and if profound erudition, a noble theme, and a fertile play of imagination are the first tests of an historical novel, this praise is justified. Yet it was not a commercial success when it appeared during 1862-63 in the *Cornhill Magazine*, which had paid £7000 for the serial rights; and critics most familiar with Italian life, such as Browning, Rossetti, and William Story, frankly said that they could not read it, because, in spite of the erudition, the book as a whole did not ring true. *Middlemarch* (1872), which represents a return to the author's earlier field, has had its share of champions. It has sometimes been defined as a great prose epic of English provincial life, a huge picture of the manners and customs

of social strata a degree or two higher up than the Dodsons and the Poysers. Like real life, it is composite, an intricate fabric of many interwoven stories. Yet the principal actors—Dorothea and Casaubon, Rosamund and Lydgate—stand out distinct, familiar portraits in the permanent gallery of characters in English fiction. The fiercest controversy of all has been waged over *Daniel Deronda* (1876). It has been stigmatized as a tendency novel, the strongest proof of Lewes's pernicious influence. The characters have been pronounced severally and collectively unreal. Mordecai has been declared a bore, and his dream of restoring the Jewish nationality chimerical. Deronda himself is "an amiable monomaniac and prosy moralist." Yet other critics have seen in it "a work as far superior to *Adam Bede* as *Hamlet* is superior to *Much Ado About Nothing*," an effort to scale the loftiest heights and sound the lowest depths of human nature, and, conceding the impossibility of the task, have recognized the nobility of the partial failure.

George Eliot's serious claims to recognition as a poet rest almost wholly upon one long dramatic poem, *The Spanish Gypsy* (1868). The motive is a young girl's renunciation of happiness when, on the eve of marriage, she learns that her father is a gypsy, who is about to found a gypsy nation in Africa and requires her to sacrifice lover, country, and religion, in order to join him. The verse, however, is at best not of a high order, and the plot lacks common sense. In 1869 she published *Agatha*, a poem, and in 1876 *Jubal and other Poems*. Whatever popularity she has as a poet rests on the verses "O may I join the choir invisible." The first collected edition of her works was made in Edinburgh and London, 1878-80. An excellent recent edition in 25 vols. was published in Boston, Mass., in 1908. Consult: Haton, *George Eliot in Derbyshire* (London, 1876); *George Eliot's Life as Related in her Letters and Journals*, arranged and edited by her husband J. W. Cross (3 vols., ib., 1885); Parkinson, *Scenes from the George Eliot Country* (Leeds, 1888); James, *Partial Portraits* (London, 1888); Blinde, *George Eliot* (ib., 1883); Dowden, *Studies in Literature* (ib., 1878); Browning, *Life of George Eliot* (ib., 1892); Harrison, *The Choice of Books* (ib., 1896); Stephen, *George Eliot* (New York, 1902); Mottram, *The True Story of George Eliot in Relation to Adam Bede* (London, 1905); Brownell, *English Prose Masters* (New York, 1909); Deakin, *The Early Life of George Eliot* (Manchester, 1913).

**ELIOT, or ELIOTT, GEORGE AUGUSTUS.** See HEATHFIELD, GEORGE AUGUSTUS ELIOT, BARON.

**ELIOT, SIR JOHN** (1592-1632). An English patriot and statesman, born at Port Eliot, Cornwall, April 20, 1592. He spent three years at Exeter College, Oxford, where, however, he did not take a degree, and after studying law traveled on the Continent, where he became friendly with George Villiers, afterward Duke of Buckingham. At the age of 22 he entered Parliament and at 27 was made vice admiral of Devon, in which office he captured Nutt, a famous pirate, whose depredations were a constant infliction upon the commerce of the south-west coast. By bribery Nutt obtained his release and continued his depredations, while Eliot was imprisoned, on false charges, for four months in the Marshalsea. He received popular sym-

pathy and immediately upon his release, in 1624, was returned to Parliament, where, during the first three parliaments of Charles I, with Pym, Hampden, Selden, and Coke, he was the foremost leader in resisting the encroachments of the crown. He brought forward the idea of the separation of the different departments of government, which was later concretely expressed by Montesquieu. He spoke boldly against the venality of the ministry and the unwarranted foreign policy of his former friend Buckingham and urged Parliament to withhold supplies until an account was given of the money already voted. In 1625 he was instigator and leader of an attempt to impeach the Duke of Buckingham. He promulgated the theory of a responsible ministry. For comparing Buckingham to Sejanus he was imprisoned in the Tower in 1626, but the Commons compelled his release and exonerated him by special vote. He suffered another short imprisonment for petitioning the King against forced loans and later received sentence of outlawry. These persecutions only increased his popularity, and, though strenuously opposed by the court, he was again returned to Parliament in 1628. He took part in drawing up the Petition of Right and on the last day of that Parliament directed Holles and Valentine to hold the Speaker in the chair by force, while he read a protest against tonnage and poundage and other taxes and acts unauthorized by Parliament. Being summoned before the Council, with Holles, Selden, Valentine, and others, he refused to answer for his acts in Parliament except to Parliament itself and was confined in the Tower, with his fellow members, for more than two months, until popular indignation compelled the King to bring him to trial. The offenders were heavily fined and sentenced to be imprisoned during the King's pleasure, and not to be released until they had given security for good behavior, submitted to the King, and atoned for their offenses. The confinement of the members was greatly relaxed until they were all released, but Eliot could make no conscientious submission. The rigor of his imprisonment was increased, and his health suffered. His simple and manly petitions for temporary release were ignored, and he was allowed to sicken and die after two years' imprisonment, on Nov. 27, 1632. His death contributed largely to the downfall and execution of Charles. During the Commonwealth Eliot's sentence of conviction was reversed by act of Parliament. His writings include: *The Monarchy of Man* (1879); *An Apology for Socrates*, his own defense (1881); *Negotium Posterorum*, an account of the Parliament of 1625 (1881); *De Jure Majestatis* (1882); the *Letter-Book of Sir John Eliot* (1882). Consult John Forster, *Life of Sir John Eliot* (2d ed., London, 1871), and Gardiner, *History of England*, vols. v-vii (ib., 1893-95).

**ELIOT, JOHN** (1604-90). A clergyman and missionary of Roxbury, Mass., known as "the Apostle to the Indians." He was born at Widdowbury, Hertfordshire, England, in 1604. He was educated at Jesus College, Cambridge. Influenced by Thomas Hooker, he became a non-conformist, and went to Boston in 1631. For a year he preached in the church of Mr. Wilson in Boston, and in 1632 became settled as "teacher" of the church in Roxbury. He remained there the rest of his life. He acquired

the language of the Pequot Indians from a young native taken prisoner in 1637. He first preached before the Indians without an interpreter at Nonantum, now Newton, about 5 miles west of Boston, on Oct. 28, 1646. This was the beginning of years of toil for the conversion of the Indians, during which Eliot traveled northward to the Merrimac River and into the southeastern part of Massachusetts and suffered many hardships of weather, travel, and opposition from the native sachems and priests. It was Eliot's policy to separate his converts from their old life and gather them into communities of "praying Indians." Such a settlement was made at Natick in 1651, and an Indian church organized there in 1660. He subsequently organized 16 such settlements. A "Society for the Propagation of the Gospel Among the Indians" was formed in London in 1649 and annually sent Eliot a sum of money to supplement the salary he received from the church at Roxbury. The outbreak of King Philip's War in 1675 interrupted the work and broke up the settlements of Christian Indians, but the latter rendered valuable service to the Colonists during the war. Eliot's *Catechism*, the first book printed in the Indian language, was published in 1653. His translation of the Bible was completed in December, 1658; the New Testament was published at Cambridge, Mass., in 1661, the Old Testament in 1663. It was the first Bible printed in America. A revision, in preparing which he had the assistance of the Rev. John Cotton, of Plymouth, was printed in 1680-85. His *Indian Grammar Begun* was printed at Cambridge in 1666. Of his *Indian Primer* (1669) the only complete copy known to exist is in the library of the University of Edinburgh. Other primers, catechisms, and translations of religious works for the Indians were prepared by Eliot. He assisted in preparing the famous "Bay Psalm-Book" (1640) and wrote several works in English. His *Christian Commonwealth, or the Civil Polity of the Rising Kingdom of Jesus Christ*, published in London in 1659, was criticized as containing seditious sentiments. After the Restoration the Governor and Council of Massachusetts required him to retract some of his statements. Eliot was a man of attractive personality, simple in life and manners, and kind in temper. He died at Roxbury, May 21, 1690. Consult: Francis, *John Eliot, the Apostle to the Indians*, in "Library of American Biography," vol. v (Boston, 1836); Winsor, *Memorial History of Boston*, vol. i (Boston, 1880-81); Walker, *Ten New England Leaders* (New York, 1901).

**ELIOT, SAMUEL** (1821-98). An American educator and historian. He was born in Boston, graduated at Harvard in 1839, and spent some years in study and travel in Europe. In 1856 he became professor of history and political science at Trinity College, Hartford, Conn., and from 1860 to 1864 was president of the same institution. From 1870 to 1873 he was a lecturer on history at Harvard, from 1873 to 1876 was head master of the Girls' High School in Boston, and from 1876 to 1880 was superintendent of the Boston public schools. As president of the American Social Science Association, he was active in the first organized movement for the reform of the civil service in 1869. He is the author of numerous historical works, among which are *The Ancient Romans* (1853) and *The Early Christians* (1853), forming the

first two parts of a projected *History of Liberty; A Manual of United States History between the Years 1792 and 1850* (1856, 1873); *Life and Times of Savonarola* (1856); *Poetry for Children* (1879); *Stories from the Arabian Nights* (1879); *Selections from American Authors* (1879).

**ELIOT, SAMUEL ATKINS** (1862- ). An American Unitarian clergyman, son of Charles W. Eliot. He was born at Cambridge, Mass., graduated from Harvard in 1884 and held pastorates at Denver, Colo. (Unity Church, 1889-93), and Brooklyn, N. Y. (Church of the Saviour, 1893-98). From 1898 to 1900 he was secretary of the American Unitarian Association, and in 1900 he became its president. He wrote *A History of Cambridge, Massachusetts, 1630-1913* (1914) and contributed to the *NEW INTERNATIONAL ENCYCLOPEDIA*.

**ELIOT, SIR THOMAS.** See **ELYOT**.

**ELIOTT, GEORGE AUGUSTUS.** See **HEATHFIELD, GEORGE AUGUSTUS ELIOT, BARON**.

**EL'IPANDUS.** See **ADOPTIAN CONTROVERSY**.

**EL'IPHAZ.** One of the friends of Job. He is described in Job ii. 11 as a Temanite. The reputation for wisdom of the Edomites probably accounts for the choice of a native of the Edomitish district of Teman as the leader of the three friends. In the dialogues his speeches are characterized by a certain courtly dignity, kindness of judgment, and grace of style not so marked in the other interlocutors. His appeal to the authority of revelation and his general attitude are best reflected in the classical description of his vision in the night (Job. iv. 12-21). See **JOB**.

**ELIS** (Lat., from Gk. Ἠλῖς, Elean *Fális, Valis*; connected perhaps with Lat. *vallis*, valley). One of the ancient divisions of the Peloponnesus, bounded north and northeast by Achæa, east by Arcadia, south by Messenia, and west by the Ionian Sea. It was originally divided into three districts—Cœle (or Hollow) Elis, Pisatis, and Triphylia. Of these the first named occupied the northern part and was by far the largest and most valuable, comprising the fertile plains watered by the Peneus and the Ladon, and producing excellent crops of wheat, cotton, and flax; while the pastures by the river banks reared cattle and horses of proverbial excellence. Pisatis, in the central portion, is drained by the Alpheus and is separated from Cœle Elis by Mount Pholœ, a spur of Erymanthus. The low grounds of this division possess great natural fertility. Its southern border was the Alpheus, at whose juncture with the Cladeos was situated the great sanctuary of Olympian Zeus. (See **OLYMPIA**.) South of the Alpheus was Triphylia, a continuation of the Arcadian hill country. Pisatis and Triphylia were subject districts, the ruling Eleans, or Epeians, dwelling on their fertile estates in the north. Though Elis had no natural strongholds and few fortified towns, it yet suffered little from war before the end of the fifth century B.C.—an advantage due in part to the sacred character of the country as the seat of the greatest of the national festivals and in part to its political situation, for the Elean oligarchy which controlled the cities early united the state to the Spartan League. During the Peloponnesian War, however, the Athenians harried the coasts, and from that time the fertile territory was frequently plundered. The inhabitants seem to have been unwarlike, and were



accused by the other Greeks of being addicted to lying, drunkenness, and licentiousness. Their prerogative of holding the Olympic games gave the Eleans a prestige which they continued to enjoy in greater or less degree till the games themselves were suppressed by the Emperor Theodosius in 394 A.D. Elis, now Kaloskopi, the capital of Elis, stood on the Peneus, and after its extension in 471 B.C., through the incorporation with it of various villages, became one of the important cities of Greece. Here were the three gymnasia in which all the competitors at the Olympic games were obliged to train for a month before the games at Olympia. Since 1899 Elis has formed a nomarchy of the Kingdom of Greece, the capital being Pyrgos. Consult Leake, *Travels in the Morea* (London, 1830), and Curtius, *Peloponnesos* (Gotha, 1852).

**ELISHA** (Heb., *Elisha*, God is deliverance). A prophet of Israel, who continued the movement of Elijah against the Baal cult. The story of his career is told in 2 Kings ii, ix, xiii, as follows: He was the son of Shaphat and lived at Abel-meholah, where until his call he was a farmer (1 Kings xix. 19). While at Horeb, Elijah is told to appoint Elisha his successor; this he does by throwing his mantle over him, whereupon Elisha sacrifices the oxen with which he was plowing, and follows Elijah. During the life of his master nothing is heard of Elisha until immediately before Elijah's death. Elisha follows him from Bethlehem to Jericho and then across the Jordan, which Elijah divides with his mantle, and as Elisha is taken up he receives the mantle of his master (2 Kings ii. 13). Elisha also divides the Jordan and comes to Jericho, where he heals the poisonous waters (2 Kings ii. 19-22). On the road to Bethlehem he is met by children who laugh at him for his bald head. He curses them, and 40 of their number are devoured by two she bears (2 Kings ii. 23-25). He severely rebukes Jehoram and refuses to speak to him, but prophesies for the sake of Jehoshaphat (2 Kings iii). A wife of one of the sons of the prophets coming to Elisha for aid, he performs the miracle of the oil (2 Kings iv. 1-7) and restores to life the son of another woman who has befriended him (2 Kings iv. 8-37). Another miracle like that performed at Jericho was the removing of the poison from the food prepared by the sons of the prophets (2 Kings iv. 38-41). Still another miracle is the making 20 loaves of bread serve 100 men (2 Kings iv. 42-44). He cures Naaman of Syria of his leprosy and refuses to take any return for it and curses his servant Gehazi for having taken a present (2 Kings v). He strikes the Syrian army with blindness, but sends them away in peace after he has brought them to Samaria (2 Kings vi. 8-23). When he sees Hazael, he knows at once the suffering that will be brought on Israel, but still tells Hazael that he will be king (2 Kings viii. 7-15). To fulfill the prophecy of Elijah, Elisha sends a prophet to anoint Jehu, who promptly kills the family of Ahab and takes the throne (2 Kings ix). Before his death Elisha is visited by Joash and predicts three victories against the Syrians (2 Kings xiii. 14-19). Even after his death Elisha performs miracles; a body thrown upon his bones revives and stands up (2 Kings xiii. 20-21).

The character of the Elisha stories, it will be seen, is very much the same as that of those told of Elijah. Both perform miracles, restoring

dead persons to life, striking the living with disease, predicting victories or disasters, and the like. While not so rugged as Elijah, he surpasses the latter in the political influence that he exercises. The narrative clearly indicates a progress towards the recognition of Yahwe to the exclusion of the Baal cults, so that Elisha's path is considerably smoother, owing to the antecedent activity of Elijah. Consult Dodds, *Elisha the Man of God* (1904), and Erbt, *Elisha, Jona* (1907).

**ELIS'SA.** See DIDO.

**ELIX'IR** (Fr. *élixir*, OF., Sp. *elixir*, from Ar. *al iksir*, the philosopher's stone, probably from Gk. *ἐξῆρος*, *weros*, dry, less plausibly from Ar. *kasara*, to break). A term in pharmacy, applied to various preparations, consisting mostly of solutions of aromatic and bitter vegetable substances in spirits of wine. The term "tincture" is now more common. *Elixir of vitriol*, or aromatic sulphuric acid, is prepared from 1½ fluid ounces of sulphuric acid, 10 fluid ounces of rectified spirit, ½ ounce cinnamon in powder, 1 ounce ginger in powder. While elixirs are made in great variety, but three are official in the United States Pharmacopœia: Elixir Aromaticum, Elixir Adjvans (both flavorings), and Elixir of Quinine, Iron, and Strychnine. See CHEMISTRY.

**ELIZABETGRAD**, yě-lě'sa-bět-grad'. See YELIZAVETGRAD.

**ELIZ'ABETH.** A city and the county seat of Union Co., N. J., 12 miles by rail southwest of New York City, and 4 miles south by west of Newark, on the Elizabeth River, Staten Island Sound, and on the Central of New Jersey, the Pennsylvania, and the Lehigh Valley railroads (Map: New Jersey, D 2). Elizabeth has steamboat connection with New York, and its shipping facilities by land and water are extensive. Its port is accessible to vessels drawing 25 feet at low water and it receives large quantities of coal and iron brought by rail from the Pennsylvania mines for reshipment. The principal industrial establishments are sewing-machine works, oil refineries, foundries, chemical works, leather and rubber works, shipbuilding plants, and manufactories of wire and cable, tools, electro motors, castings, machinery, and bronze powder. The value of the combined output of the industries in 1909 was \$29,147,000. Elizabeth is the suburban home of many New Yorkers, is laid out with broad and well-paved streets, and has several parks and many fine residences. It contains also a public library, three hospitals, an orphan asylum, and a splendid high-school building.

The city has several places of historical interest. It was settled in 1664 by a company from Long Island, and on May 26, 1668, the first General Assembly of New Jersey convened here. Elizabeth was the capital of the Colony from 1755 to 1757 and suffered greatly during the Revolution. It was chartered as the "Borough of Elizabeth" in 1789, incorporated as a town in 1796, and received a city charter in 1855. The city's receipts in 1913 amounted to \$2,211,200; its expenditures were \$2,127,900, the chief items being: police, \$106,000; fire, \$87,000; education, \$280,000. The College of New Jersey, founded here in 1746, later developed into Princeton University. Alexander Hamilton and Aaron Burr spent part of their early lives at Elizabeth. There are many fine types of architecture of the Revolutionary period still standing. Pop., 1890, 37,764; 1900, 52,130; 1910, 73,409; 1914

(U. S. est.), \$2,411. Consult Hetfield, *History of Elizabeth* (New York, 1868).

**ELIZABETH** (1533-1603). Queen of England. She was the daughter of Henry VIII and the unfortunate Anne Boleyn and was born Sept. 6, 1533. While she was yet in her third year, her mother was beheaded. After the mother's execution Elizabeth was sent to the country, where the greater part of her early youth was spent. When Catharine Parr became Queen, Elizabeth, who was a favorite with her, was more often seen at court; but for some unknown cause she incurred her father's displeasure and was again sent to the country. Her father died when she was 13 years old. During the reign of her brother, Edward VI, her life passed quietly and peacefully. She was then remarkable for great demureness, so that Edward used to speak of her as his "sweet sister Temperance." Her Protestantism, and the court which was paid to her by the Protestant nobility, caused uneasiness to Edward's successor, Mary, and her Council. At her sister's command she conformed to the Roman Catholic faith, but the insincerity of the conversion imposed upon no one. On the pretext of having been concerned in Wyatt's rebellion, she was sent in 1554 to the Tower. The warrant for her execution was at one time prepared, but her popularity saved her, as her sister's advisers feared an uprising if Elizabeth were put to death. Nevertheless for some time longer she was kept a prisoner at Woodstock. During the remainder of Mary's reign Elizabeth, though occasionally at court, resided chiefly at her residence at Hatfield House in Hertfordshire.

When Mary died, Nov. 17, 1558, Elizabeth was 25 years of age. Her accession was welcomed alike by Catholics and by Protestants. She then began, amid dangers and difficulties, a reign which, contrary to the expectation of all, was of unexampled length and prosperity. It would be wrong not to attribute to her influence some effect in producing the great changes which during the next 44 years took place in England; but so far as these changes were not produced in the natural course of the development of the nation's power, and so far as they bear the mark of an individual mind, they bear much more the impress of the bold yet cautious judgment and clear intellect of her great minister, Cecil, than of Elizabeth. The essentially Protestant character of her policy was shown at the very beginning of her reign, and in consequence of this a Protestant majority was returned to her first Parliament. In 1559 a new Act of Supremacy was passed. In 1560 Elizabeth concluded a treaty of alliance at Berwick with the Scottish Reformers, who were joined by an English force. The Thirty-nine Articles of the Church of England were published in 1563.

The policy of Elizabeth's ministers, on the whole, was one of peace and economy. No war was undertaken in her reign for the sake of territorial conquest. To strengthen her own throne, Elizabeth assisted the Protestants in Scotland, in France, and in the Low Countries; but she had few open wars. To maintain her own security, and to prevent foreign interference in English matters, was the mainspring of her foreign policy; and she lost no opportunity of weakening and finding occupation abroad for any foreign power that unduly threatened her authority. Her diplomacy was tortuous and swayed by innumerable changes of mind, but she usually

attained her ends. Her parsimony was well known and sometimes disastrous. Had she given ample succor to the Dutch, as the English nation wished, the result of the war would have been much more advantageous to England. The inadequate provisions and ammunition of the English fleet would likely have led to bad results had the Spanish Armada been placed in more competent hands. However, her parsimony was necessary while the nation was poor. The one great blunder of Elizabeth's policy was the treatment of Mary, Queen of Scots, who, after her defeat by the Regent Murray at Langside in 1568, had sought refuge in England, only to become a captive in the hands of the English Queen. Daring neither to execute her prisoner, as several of the ministers advised, nor to release her, in which case she would probably have gone to Spain or France and by a foreign marriage have forfeited the sympathies of the Scottish and English Catholics, Elizabeth retained her a prisoner, and thus for years gave cause for conspiracy after conspiracy among the English Catholics. For a rebellion incited to set Mary free, the richest and most popular of the English nobles, Norfolk, was executed in 1572. The plots then took on a graver aspect. The assassination of Elizabeth and the placing of Mary on her throne became their object. On the discovery of Babington's conspiracy for this purpose, the popular cry for Mary's death was irresistible, and was joined in by Cecil, Walpole, and others of Elizabeth's ministers. With reluctance and hesitation Elizabeth consented; and Mary, after long years of confinement, was condemned and executed in 1587.

This led to new evils. The participation of the Catholic party in the plots was punished by persecution. Many suffered under an Act passed in 1585 making it treason for a Catholic priest to be in England, and felony to harbor one. These measures were the ultimate means of bringing upon England a most menacing foreign attack. Philip of Spain had long meditated vengeance against England for her aid to the Dutch Protestants against Alva and for her freebooting attacks on Spanish commerce. To restore the Catholic faith and to avenge the death of a Catholic queen furnished reasons which were more than pretexts to Philip, who was filled with the desire to promote the Catholic faith. In 1588, after years of preparation, the "Invincible Armada" (see ARMADA) sailed from the Tagus, manned by 8000 sailors and carrying nearly 20,000 soldiers. To aid them a land army of 100,000 men was to be transported from the Netherlands under the Duke of Parma. The news roused all England, and every man who could carry arms from 18 years of age to 60 was enrolled in the forces. The Queen herself rode at Tilbury, energetically encouraging the army. The English fleet, under Howard and Drake gathered on the southern coast, awaited the attack. Superior skill and courage gained the victory for the English; and what they had begun the force of the elements completed. The splendid armada was broken and destroyed before it could join the land army, and the great Spanish expedition came to naught.

The close of Elizabeth's reign was disturbed by a formidable revolt in Ireland under the Earl of Tyrone. The Queen's favorite, Essex, who was sent against him, showed himself utterly incompetent; but the Irish leader succumbed at last to the arms of Lord Mountjoy.



QUEEN ELIZABETH  
FROM AN ENGRAVING BY T. A. DEAN, AFTER A PAINTING BY FREDERIGO ZUCCARO



Elizabeth died March 24, 1603, at the age of nearly 70 years. Always parading her wish to live an unmarried life, Elizabeth coquetted with suitor after suitor. She was scarcely more than a child when her flirtations with the handsome Lord Admiral Seymour, the brother of the Protector Somerset, had passed the bounds of decorum. In Mary's reign Elizabeth was flattered by the attentions of her kinsman, the Earl of Courtenay, and she declined the hand of Philibert of Savoy, pressed on her by her sister's Council. When Queen, she refused with some hesitation the offer of Philip II, who was desirous of perpetuating his influence over England, and she began a connection with the Earl of Leicester which seriously compromised her character. If we credit those sources of information which are found in the dispatches of the Bishop of Aquila, Ambassador of Philip II in London, preserved in the archives of Simancas, not only was the moral character of Elizabeth sullied, but even the quality for which she has ever been most honored, her English patriotism, was mere affectation. These dispatches represent her as proposing to Spain to become a Catholic and to restore the Spanish ascendancy in England if Philip would support her on the throne as the wife of Leicester. That there is some basis of truth in this revelation can scarcely be denied; but, aside from the fact that the Bishop exaggerated, Elizabeth, who was often mendacious, was probably deceiving him. If she really intended to marry Leicester, she was prevented by the advice of her ministers, especially of Cecil. Among less distinguished suitors the Archduke Charles of Vienna and Prince Eric of Sweden urged their suit in vain. Petitions from Parliament to the Queen to marry produced only dignified replies that she would attend to the matter when the time came. Catharine de' Medici, Queen mother of France, intrigued to marry her to one of her sons, Henry of Anjou, with whom she carried on an absurdly ardent courtship for a lady 18 years his senior. Her last favorite was the Earl of Essex, unworthy but good-looking, whom she executed for treason. Nevertheless she never let affairs of state be guided by these favorites, but relied on the wisdom of her ministers, chief of whom were William Cecil, Lord Burghley, and Sir Francis Walsingham, her Secretary of State.

Elizabeth's position gave notoriety to the unamiable and ridiculous features of her character. She was vain in dress, rather mannish in demeanor, and lacked fine feeling; but in her reign the reckless waste of human life which marked the reigns of her predecessors was unknown. The cruel persecutions of the Catholic seminary priests are in line with the spirit of the times and are not to be attributed to Elizabeth personally. By her attendants she was feared more than loved. The one quality which never failed her was personal courage; and when she chose, her demeanor was stately and royal. Religion was with her, as with a great proportion of the nation at that time, a matter more of policy and convenience than of feeling or principle. She preferred Protestantism because of early associations and because it gave her the headship of the church, freed her from foreign interference, and was more acceptable to her ministers and to the nation. The above estimate of Queen Elizabeth is based upon the famous chapter in Green's *History of the English People* describing the character of the Queen.

In the long reign of Elizabeth the true greatness of England began. Freed from the possession of those French provinces which rather harassed than enriched, with little domestic commotion, with no foreign wars, with an almost complete immunity from religious persecution, the nation turned to the arts of peace. An unequalled literature arose. The age that produced Spenser, Shakespeare, and Bacon could not be other than famous. Under Frobisher and Drake maritime adventure began, and the foundations of the British navy were laid. Commerce, from being a small matter in the hands of a few foreign merchants, assumed great proportions. The Royal Exchange of London was opened in Elizabeth's time, and in the charter granted to that company of merchants which afterward took the name of the East India Company may be seen one of the small beginnings of the vast colonial British Empire. The social condition of the people also greatly improved in her reign. The crowds of vagabonds which the monastic institutions had fostered, and which had been increased by the eviction of tenants on monastery lands, died out or were absorbed in industrial employments. The last traces of bondage disappeared. Simultaneously with the growth of greater comfort and intelligence in the people, Parliament began to assert with greater vigor its constitutional rights. The right of the Commons to free speech and to initiate all money bills was steadily asserted, and the right of the crown to grant monopolies or to issue proclamations having the force of law vigorously assailed, and the reign of Elizabeth may be said to mark the transition from mediæval to modern England.

There is abundant original material for a biography of Elizabeth. Chief among the sources is the *Calendar of State Papers* of her reign, especially the *Spanish Series*, ed. by M. A. S. Hume (London, 1892-99). The *Manuscripts at Hatfield House* (Royal Historical Manuscripts Commission, 1888-95) are most useful; as are the *Burghley Papers*, ed. by S. Hayes (London, 1740) and W. Murdin (ib., 1759). *Synarchy Papers*, ed. by A. Collins (ib., 1746), *Miscellaneous State Papers*, ed. by Earl of Hardwicke (ib., 1778), and others. Several of the *Camden Society Publications* are also very useful: *Letters of Elizabeth and James VI*, ed. by J. Bruce (1849); *Machyn's Diary*, ed. by J. G. Nichols (1848); and *Walsingham's Chronicle*, Camden Miscellany (1847-75). The most important contemporary account of the reign is that by W. Camden, *History of Queen Elizabeth* (1622), and a continuation by Godwin in Kennet's *Complete History of England* (London, 1740). Consult Strype, *Annals of the Reformation* (new ed., Oxford, 1824), a standard for ecclesiastical matters, and D'Ewes, *Journals of All the Parliaments of the Reign of Queen Elizabeth*, ed. by P. Bowes (London, 1682), which is indispensable. Among modern authorities the most detailed account of the reign is to be found in Froude, *History of England*, vols. vii-xii (New York, 1870); Wright, *Queen Elizabeth and her Times* (London, 1838), based on private letters of the reign; Creighton, *Queen Elizabeth* (ib., 1899), a good popular life, as is E. S. Beesley, *Queen Elizabeth* (ib., 1902); but perhaps the best is A. Jessup's excellent article in the *Dictionary of National Biography*. Strickland's *Lives of the Queens of England* (New York, 1867) contains a life of Elizabeth which is useful as a personal memoir, and Wiesener's *La*

*jeunesse d'Elisabeth d'Angleterre, 1533-58* (Paris, 1878, Eng. trans. by C. M. Young, 1879), deals with Elizabeth's youth. For the constitutional development of Elizabeth's reign consult: the works of Hallam, vol. i, chap. v; Taylor, vol. ii, bk. iv, chap. v; Gneist, vol. ii, chaps. xxx-xxxvi, passim (full titles cited under GREAT BRITAIN). For economic development, Traill, *Social England*, vol. iii, chaps. xi, xii, and Cunningham, *English Industry*, vol. ii, bk. vi. The last years of the reign are treated exhaustively in E. P. Cheyney, *A History of England from the Defeat of the Armada to the Death of Elizabeth*, vol. i (London, 1914). The Elizabethan religious settlement is the subject of a brilliant contribution by F. W. Maitland to the *Cambridge Modern History* (vol. ii, chap. xvi).

**ELIZABETH** (1545-68). A queen of Spain, daughter of Henry II of France and of Catharine de Medici. She was born at Fontainebleau, and although from infancy pledged in marriage to Don Carlos, the heir presumptive to the Spanish throne, afterward espoused the father of the latter, Philip II. Owing to the cruelty of Philip and the early death of the parties concerned, the story of an attachment between Elizabeth and Don Carlos gradually spread among the people. It has been perpetuated in several stories and romances, and notably in Schiller's celebrated drama *Don Carlos*. There seems to be nothing in the known facts of the history of the period to substantiate the legend, and it is well known that Elizabeth, like all the rest of his wives, fairly adored Philip II.

**ELIZABETH** (1618-80). A Princess Palatine. She was born at Heidelberg, the eldest daughter of the unfortunate Elector Palatine Frederick V, for a brief period King of Bohemia, and of Elizabeth Stuart, daughter of James I of England. She was brought up at The Hague and was a pupil of William Penn in religion and of Descartes, who dedicated to her his famous *Principia Philosophiæ*, and who found in her the rare union of metaphysical and mathematical capacity. She was nicknamed "la Grecque." She refused an offer of marriage from the King of Poland and in 1667 became Abbess of Herford, thereafter gathering about her mystics of various kinds.

**ELIZABETH, AMÉLIE EUGÉNIE**, à-l'zà-bět à-mä'l'è-ä oi-gä'né-ä (1837-98). Empress-queen of Austria-Hungary, wife of Francis Joseph, ruler of the Austro-Hungarian monarchy. She was a daughter of Duke Maximilian Joseph of Bavaria. She was a remarkably beautiful and intelligent woman and spoke a number of languages. A daring horsewoman and fond of sports, she spent much of her time on her estates or in travel. While on a visit to Geneva, she was stabbed (Sept. 10, 1898) by Luccheni, an Italian anarchist, and died a few minutes afterward. Consult: De Burgh, *Elizabeth, Empress of Austria* (London, 1898); Friedmann, *Kaiserin Elisabeth* (Berlin, 1898); and the anonymous and gossipy *Martyrdom of an Empress* (London, 1899).

**ELIZABETH, CAPE**. See CAPE ELIZABETH.

**ELIZABETH, PAULINE ELISABETH OTILIE LOUISE** (1843- ). Queen of Rumania; known as a poet and novelist, under the name of Carmen Sylva. She was born at Neuwied, Germany, a princess of Wied, but after her marriage with Prince Charles of Rumania, in 1869, she identified herself with the Rumanian people. In the Russo-Turkish War of 1877-78 she was

untiring in her care of the wounded. The customs and the folklore of the Rumanians are the subjects of her poetry, which is full of homely beauty in its expression of nature and life. She was elected in 1914 an honorary fellow of the Royal Society of Literature of the United Kingdom. Among her numerous books in verse and prose are: *Leidens Erdengang* (1882; 5th ed., 1899, trans. into English by Helen Zimmern as *Pilgrim Sorrows*); *Jehovah* (1882); *Pensées d'une reine* (1882); *Handwerkerlieder* (1891); *In der Lunca* (1904); the essays, *Geflüsterte Worte* (1903; 1906). For her biography, consult Diederich (Leipzig, 1898) and Roosevelt (London, 1891).

**ELIZABETH, PHILIPPINE MARIE HÉLÈNE**, called MADAME ELIZABETH (1764-94). A princess of France, sister of Louis XVI, born at Versailles. She was of a noble and charitable disposition and, although she had never participated in politics, was prompted by her sense of duty and her affection for her family to leave their countryseat at the outbreak of the Revolution in order to be at the side of her brother, the King of France. Accused of carrying on a correspondence with the royal princes and of providing them with money, she was sentenced by the Revolutionary Tribunal, May 9, 1794, and executed the following day. Consult Mrs. Maxwell-Scott, *Madame Elizabeth of France* (1908).

**ELIZABETH, SAINT** (1207-31). The daughter of Andrew II, King of Hungary, born at Pressburg. At the age of four she was affianced to Louis, eldest son of the Landgrave of the Thuringia, and was taken to the Wartburg to be educated under the eyes of the parents of her future husband. She early displayed a passion for asceticism as it was conceived in those days. She despised pomp, avarice, and ambition, cultivated humility, and exhibited the most self-denying benevolence. Her conduct even as a girl astonished the Thuringian court; but such was the grace and sweetness of her disposition and the excellence of her beauty that Louis, though her affections seemed to be given wholly to God, still wished to marry her. They were united when Elizabeth was only 14. On the death of her husband in 1227 she was deprived of the regency by the brothers of her deceased husband and driven out, together with her four children, on the plea that she wasted the treasures of her state by her charities. Later she was offered the regency, which she refused. She spent her last days as a member of the third order of St. Francis, subjecting herself to mortifications which shortened her life. She was canonized in 1235. Charles Kingsley's dramatic poem, *The Saint's Tragedy*, is founded on the story of Elizabeth's life. Consult Montalembert, *Life of St. Elizabeth*, trans. by F. D. Hoyt (London and New York, 1904), and Wenck, *Die Heilige Elisabeth* (Tübingen, 1908).

**ELIZABETHAN ARCHITECTURE**. A term applied to the mixed style which sprang up in England on the decline of Gothic architecture. By some it is confused with the Tudor style (q.v.), out of which it sprang. The Elizabethan is chiefly exemplified by mansions erected for the nobility in the reigns of Elizabeth and James I, and originated in the new conditions of domestic life and manners which marked the sixteenth and early seventeenth centuries. The gradual change of style in manor houses and palaces reveals the first introduction of

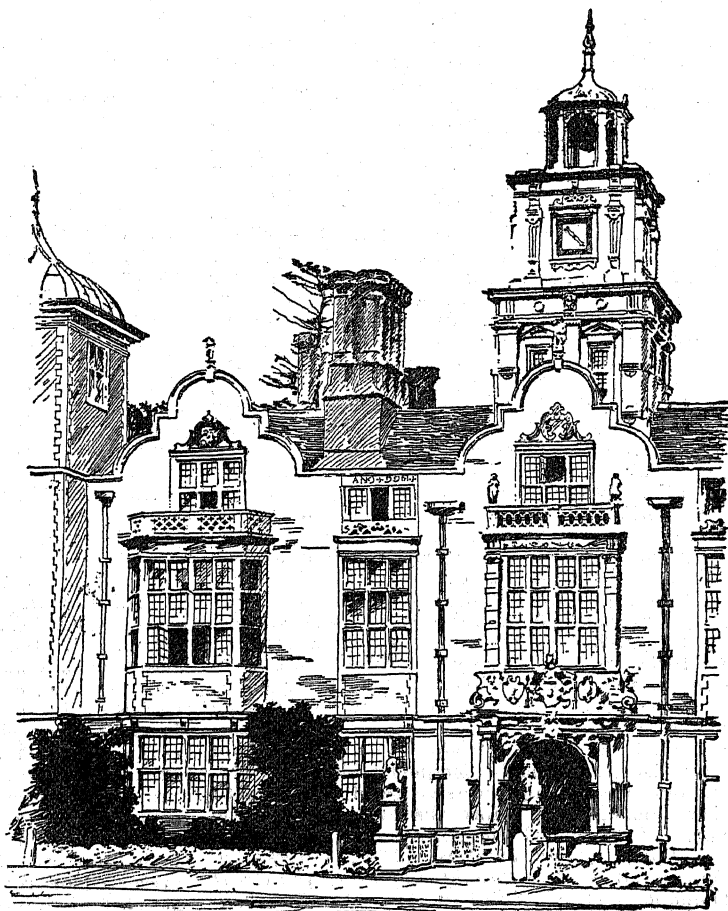


classic details, influenced, no doubt, by Holbein, who was patronized by Henry VIII and furnished several designs in this manner, and by the relations of England with Protestant Holland and Germany, from which, rather than from Italy, the new forms were derived. John of Padua succeeded Holbein and built in the mixed style a palace for the Protector Somerset (for which purpose the cloisters of St. Paul's were taken down), and the mansion of Longleat for his secretary, Sir John Thynne. The curved broken gables, pilasters broken by quoins and bands, and the tormented details are characteristic. So are the vast dimensions of the apartments, the enormous square windows, the carved wooden staircases, the multiplication of fireplaces and chimneys, the picturesque gables, octagonal turrets, and projecting bay windows. The ornament, especially the "strapwork," lacks delicacy; but the plaster ceilings are often paneled with great elegance. Carved wooden screens divide some of the great halls, and open timber ceilings are still used. The classic orders, coupled and superposed but of incorrect proportions, are common as doorway decorations, and gables (see GABLE) are a frequent substitute for pilasters. The following examples of mansions of the seventeenth century may be still seen near London: Holland House, Campden House in Surrey, Bramshill in Kent, Sir T. Wilson's at Charlton, the Marquis of Salisbury's at Hatfield, and Knowle, the property of the Lord Sackville. Others are Burton Agnes, Audley End, Aston, Burghley, Kirby Hall, Montacute, Mogus Park, and Blickling. The most eminent architects of those times were John Thorpe, Gerard Christmas, Rodolph Symonds, and Thomas Holt. Consult: Richardson, *Architectural Remains of the Reigns of Elizabeth and James I* (London, 1840); Blomfield, *History of Renaissance Architecture in England* (ib., 1897); Gotch and Brown, *Architecture of the Renaissance in England* (ib., 1894).

**ELIZABETH CHARLOTTE** (1652-1721). A duchess of Orléans. She was born at Heidelberg and was a daughter of the Elector Palatine, Charles Louis, and a Hessian princess. Although thoroughly German in temperament and tastes, she was for political reasons married to Duke Philip of Orléans, brother to Louis XIV, in 1671. The fearful devastation of the Palatinate by Louis XIV (1689), which filled all Europe with horror, was the result of claims to territory which the "Grand Monarque" made on the strength of this marriage. The extensive correspondence of Elizabeth with her family (7 vols., 2d ed., published in 1867-82) and with

Leibnitz throws very interesting side lights upon the history of the period.

**ELIZABETH CITY.** A city, port of entry, and the county seat of Pasquotank Co., N. C., 53 miles south of Norfolk, Va., on the Norfolk and Southern and the Virginia and Carolina Coast railroads, and on the Pasquotank River (Map: North Carolina, F 1). Elizabeth City contains a State normal school and United States customhouse. It has a good harbor, large trucking interests, and a considerable trade in cotton, lumber, and fish, oyster cultivation being an important industry. There are saw and planing



BLICKLING HALL.

mills, shingle factories, cotton and hosiery mills, cotton gins, flour and grist mills, ironworks, machine shops, a shipbuilding yard, and manufacturing of bricks, carriages and wagons, barrels and baskets, boxes, etc. The government is vested in a mayor, who holds office for two years, a board of aldermen, and a board of control. Pop., 1900, 6348; 1910, 8412; 1914 (U. S. est.), 9292.

**ELIZABETH FARNESE**, fär-nä'zä. See FARNESE.

**ELIZABETH ISLANDS.** A group of 16 small islands belonging to Massachusetts, lying southwest of Barnstable County and between Buzzards Bay and Vineyard Sound (Map: Massachusetts, F 5). In 1864 they were in-

incorporated as Gosnold Township of Dukes County. They cover an area of 14 square miles. The islands, of which Naushon and Nashawena are the two largest, have a fine climate and scenery and afford excellent fishing. They are popular summer resorts. Permanent pop., 1910, 152. On Cuttyhunk Island the foundations of the first English colony of New England were laid in 1602 by Bartholomew Gosnold, only to be abandoned the same year.

**ELIZABETH PETROVNA** (1709-62). Empress of Russia from 1741 to 1762. She was the daughter of Peter the Great and Catharine I and was born Dec. 18, 1709. On the death of her nephew Peter II, in 1730, she suffered Anna, Duchess of Courland, daughter of Ivan V, to ascend the throne. (See ANNA IVANOVNA.) Anna died in 1740, and Ivan, the son of her niece Anna Karlovna (q.v.), an infant of two months, was declared Emperor, and his mother made Regent during his minority. Shortly after this a plot was formed to place Elizabeth upon the throne; the two principal agents in it were Lestocq, a surgeon, and the Marquis de la Chetardie, the French Ambassador. The officers of the army were won over, and on the night of Dec. 5, 1741, the Regent and her husband were taken into custody, and the child Ivan was conveyed to Schlüsselburg. By eight o'clock in the morning the revolution was accomplished. La Chetardie was handsomely rewarded; and Lestocq was created first physician to the Empress, president of the Academy of Medicine, and Privy Councillor. Elizabeth was energetic, knowledge, and a love of business, and allowed herself to be guided by favorites; for this reason corruption prevailed at her court. In order to strengthen her position she took pains to win over her nephew the young Prince Peter, the son of her sister the Duchess of Holstein-Gottorp. She summoned him to St. Petersburg in the year 1742 and proclaimed him her successor. She took part in the War of the Austrian Succession and dispatched a large army to the assistance of Maria Theresa, thereby securing the conclusion of the Peace of Aix-la-Chapelle in 1748. At the commencement of the Seven Years' War she allied herself with Austria and France against Prussia. Her troops won the battles of Gross-Jägerndorf and Kunersdorf and raided Berlin, but without any decisive result. Elizabeth died Jan. 5, 1762, before the expiration of the war. She founded the University of Moscow and the Academy of Arts at St. Petersburg. Consult: Bain, *The Daughter of Peter the Great* (London, 1899); Vandal, *Louis XV et Elisabeth de Russie* (Paris, 1862); Weidmayer, *Règne d'Elisabeth Petrovna* (St. Petersburg, 1849).

**ELIZABETH STUART** (1596-1662). A queen of Bohemia. She was the eldest daughter of James VI of Scotland, afterward James I of England, and was born at Falkland Castle in Fifeshire, Aug. 19, 1596. After 1608 she resided at court and took part in the life of the gayest circles. In 1613 she married Frederick V, Elector Palatine of the Rhine, who in 1619 was summoned by the Protestants of Bohemia to be their King. Frederick's forces were defeated by the Catholic army at Prague in 1620, and he was driven from his throne. The Palatinate was invaded in 1622 and taken from him, and the Diet of Ratisbon declared the electoral dignity forfeited. With her husband and children, Elizabeth sought refuge in Holland. Frederick died in 1632, but it was not until 1648 that the

Palatinate was restored to Elizabeth's second son, Charles Louis, the eldest, Frederick Henry, having died in 1629. She returned to England in 1661, but mingled very little in society, and died Feb. 13, 1662, at the house of Lord Craven in Drury Lane, London. Of her other children, the most celebrated were Prince Rupert (q.v.) and Prince Maurice. Her youngest daughter, Sophia, married Ernest Augustus of Brunswick-Lüneburg, later Elector of Hanover, and became the ancestress of the present reigning house of Great Britain. The best biography of Elizabeth is that by Mrs. Everett Green, in *Lives of the Princesses of England* (London, 1854), which has superseded Miss Benger's *Memoirs of Elizabeth Stuart, Queen of Bohemia* (ib., 1824). A good short account is given in R. S. Rait, *Five Stuart Princesses* (New York, 1908).

**ELIZABETHTOWN**. A city and the county seat of Hardin Co., Ky., 42 miles south of Louisville, on the Louisville and Nashville and the Illinois Central railroads (Map: Kentucky, E 4). It has flouring mills, stave and overall factories, and dairying interests, and carries on a considerable trade in live stock, grain, flour, fruit, brick, and tobacco. It has municipal water works. Pop., 1900, 1861; 1910, 1970.

**ELIZABETHTOWN**. A borough in Lancaster Co., Pa., 17 miles southeast of Harrisburg, on the Pennsylvania Railroad (Map: Pennsylvania, H 7). It contains a Masonic home and Elizabethtown College. There are manufactures of shoes, agricultural implements, shirts, wagons, and cigars, and large tobacco warehouses. Pop., 1900, 1473; 1910, 2587.

**ELIZABETPOL**, yě-lě'sá-bět-pól. See YE-LIZAVETPOL.

**ELK** (AS. *elch*, Icel. *elgr*, OHG. *elaho*, elk, Ger. *Elch*, whence probably Lat. *alces*, Gk. *ἄλκη, alkē, elk*). 1. The greatest forest deer (*Alces malchis*, or *alces*) of the northern regions of Europe and Asia and the largest existing representative of the family. A closely related species (*Alces americanus*) is known in America as the moose, under which name its characteristics are described. In the Old World the elk formerly ranged throughout all the forested region north of the mountains from England to eastern Siberia, and it still occurs rarely in Scandinavia, eastern Prussia, Lithuania, and parts of Russia, while it remains fairly numerous in western Siberia; everywhere in Europe it is protected by laws, and in most cases is preserved on royal estates, where a hunt is organized at intervals of several years. It may easily be tamed and has at various times been put to service, having at one time been trained to draw sledges in the government's courier service in Sweden. See MOOSE.

2. The American "elk," unfortunately so named by the early colonists of the United States, has no resemblance to the European broad-horned deer, properly so called (see above), but rather resembles the red deer. (See DEER.) It is described under its suitable Indian name. See WAPITI.

3. The Irish "elk" (*Cervus*, or *Megaceros, giganteus*) is another misnamed deer, which became extinct apparently soon after the advent of man in Europe. Its remains are found not only in the bogs of Ireland, but in caves and superficial deposits of England, Scotland, and the middle parts of the Continent. It was closely allied to the fallow deer, but of much

greater size, standing 6 feet in height, with unusually strong bones about the head and neck, suitable for carrying the enormous antlers which characterized it. These were broadly palmated and were so widespreading as to measure, in some known instances, almost 11 feet from tip to tip. Its bones have been found associated with the evidences of man's presence, showing that it survived his arrival and that its extermination was probably completed by human agency. Another extinct species (*Cervus rufi*), of central Europe, takes a place between this species and the fallow deer. For a description of the different kinds, see the article DEER, and for illustrations see its accompanying Plate of DEER OF NORTH AMERICA.

**EL-KATIF**, el-kā-tēf'. A fortified seacoast town of El-Hasa, Arabia, situated on the west shore of the Persian Gulf, a short distance northwest of Bahrein Island (Map: Turkey in Asia and Arabia, F 5). It has an old Portuguese citadel. Pop., about 10,000.

**ELK CITY**. A city in Beckham Co., Okla., 20 miles southeast of Cheyenne, on the Chicago, Rock Island, and Pacific and the Wichita Falls and Northwestern railroads (Map: Oklahoma, B 3). It has broom factories, a flouring mill, a cotton-oil mill, a cotton compress, an ice plant, and agricultural and other interests. The water works are owned by the city. Pop., 1900, 2195; 1910, 3165.

**ELKESAITES**, ēl-kēs'ā-its, or **ELCESAITES** (named after their reputed founder Ἐλκασαί, *Elchasai*, 'Elkesai, *Elkesai*, or Ἐλξαι, *Elxai*; they themselves derived their name from Heb. *heil kesai*, hidden might). An Ebionite (q.v.) sect of the second century which laid great stress upon baptism. They held as the highest authority a work known as the Book of Elkesai, which was known to Origen, Hippolytus, and Epiphanius. The last reports that it was believed to have been revealed by an angel who was the Son of God. Their system seems to have been a mixture of Christian elements, Jewish legalism, and Essenian asceticism, with a mixture of astrology and magic. Perhaps the chief object of the sect was to mingle Judaism and Christianity, so that the Hebrews of that day could embrace the new doctrines without entire repudiation of their old belief. The fullest account of the Book of Elkesai is found in the *Philosophoumena* of Hippolytus. Consult Brandt, *Elchasai* (Leipzig, 1912), and Rainy, *The Ancient Catholic Church* (New York, 1902).

**EL KHARGEH**, ēl-kār'ge. See KHARGEH, EL.

**ELKHART**. A city in Elkhart Co., Ind., 101 miles by rail east by south of Chicago, at the confluence of the St. Joseph and Elkhart rivers, and on the Lake Shore and Michigan Southern, the St. Joseph Valley, the Chicago, South Bend, and Northern Indiana, and the Cleveland, Cincinnati, Chicago, and St. Louis railroads (Map: Indiana, F 1). A large dam and power house, erected in 1913 at a cost of \$750,000, furnishes abundant power for its industries, which include railroad shops, musical instrument factories, automobile works, bridge and iron works, and establishments for the manufacture of carriages, invalid tables, machinery, go-carts, corsets, telephone supplies, furniture, brass sundries, gas generators, paper boxes, rubber, and paper. The city has a Carnegie library and a fine high-school building. The control of the government is vested almost entirely in the mayor, and there is a city council.

Pop., 1900, 15,184; 1910, 19,282; 1914 (U. S. est.), 21,028.

**ELKHORN**. A city and the county seat of Walworth Co., Wis., 54 miles southwest of Milwaukee, on the Chicago, Milwaukee, and St. Paul Railroad (Map: Wisconsin, E 6). There is a public library, and there are extensive fair grounds owned and operated by residents of the county. It is the centre of a fertile agricultural region and has large dairying interests and a creamery and condensed-milk plant. The electric-light plant and water works are owned by the municipality. Pop., 1890, 1447; 1900, 1731; 1910, 1707.

**ELK HORN, BATTLE OF**. See PEA RIDGE, BATTLE OF.

**ELKHORN RIVER**. A tributary of the Platte River, Neb. The main stream rises in Brown County and the north fork in Knox County (Map: Nebraska, F 2). They unite in Madison County, and the stream flows southeast, joining the Platte in Sarpy County, in the eastern part of the State, after a course of about 200 miles. The Frémont, Elkhorn, and Missouri Valley Railroad runs through this valley. The largest tributary is Logan Creek.

**ELKIN, WILLIAM LEWIS** (1855- ). An American astronomer. He was born in New Orleans, was educated at the Royal Polytechnic School, Stuttgart, Germany, and at the University of Leipzig. His astronomical investigations at the Royal Observatory, Cape of Good Hope, in 1882-83 on the parallaxes of southern stars, which investigations he undertook in association with Sir David Gill, were important. This work was supplemented in 1887-88 by his determination of the parallaxes of a number of the brightest northern stars. From 1896 to 1910 he was director of the Yale Observatory. He has published the results of many searches in the *Transactions of the Yale Observatory* and other astronomical journals.

**ELKINS**. A city and the county seat of Randolph Co., W. Va., 113 miles southwest of Cumberland, Md., on the Western Maryland and the Coal and Coke railroads (Map: West Virginia, E 3). It is the seat of Davis and Elkins College and has an Odd Fellows home, two hospitals, and an orphans' home. Its chief industries are tanning, locomotive and car repairing, and the manufacture of boxes, and extracts. Under a charter governed by a mayor, chosen annually, and a unicameral council. The water works are owned by the city. Pop., 1900, 2016; 1910, 5260.

**ELKINS, STEPHEN BENTON** (1841-1911). An American capitalist and politician. He was born in Perry Co., Ohio, graduated at the University of Missouri (Columbia) in 1860, was admitted to the Missouri bar in 1864, removed to New Mexico, and in the same year was elected to the Territorial Legislature. Subsequently he became a district attorney and Attorney-General of the Territory and United States District Attorney. From 1873 to 1877 he was delegate to Congress from New Mexico. Later he removed to West Virginia and there married the daughter of Henry Gassaway Davis (q.v.), acquired large business interests in West Virginia, particularly in the coal industry and railways, and became vice president of the West Virginia Central and Pittsburgh Railway. From 1891 to 1893 he was Secretary of War in President Harrison's cabinet, and in 1894 he was elected to the United States Senate, thereafter

being twice reflected. The Elkins Railway Law of 1903 bore his name. His son Davis Elkins succeeded him ad interim in the Senate in 1911 by appointment of the Governor.

**ELK RIVER.** See **ATHABASCA RIVER.**

**ELKS, BENEVOLENT AND PROTECTIVE ORDER OF.** A benevolent fraternal society, organized in the city of New York, Feb. 16, 1868, as the outgrowth of a social club known as the Jolly Corks, composed principally of members of the theatrical profession. Its first regular organization was New York Lodge No. 1. The Grand Lodge of the order was incorporated March 10, 1871, as chap. xix of the laws of that session, and the past officers of New York Lodge No. 1 were made the first members of the Grand Lodge under the act of incorporation. The power to form subordinate lodges was given to the Grand Lodge on March 12, 1871. Charters were issued to New York No. 1 and Philadelphia No. 2. The third lodge was incorporated April 18, 1876, in San Francisco, and subsequently lodges were formed in Cincinnati, Sacramento, Baltimore, St. Louis, Boston, Pittsburgh, Indianapolis, Providence, Washington, Denver, Cleveland, in the order named, and in other cities. The order, in addition to assisting its own members, has been a liberal contributor to the relief of suffering in national calamities like the Chicago and Boston fires, the Galveston and Johnstown floods, and the California earthquake disaster; it has since its institution dispensed nearly \$3,000,000 in such causes. The number of lodges in 1914 was 1309, and subordinate lodges have been established in Skaguay and Juneau in Alaska, Honolulu and Hilo in the Hawaiian Islands, and Manila in the Philippines. Membership in the order can be acquired only by white male citizens of the United States of the age of 21 and upward, of good moral character; only one lodge can be instituted in any one city, and such city must have a population of at least 5000, and each lodge is given complete jurisdiction over all residents within said corporation.

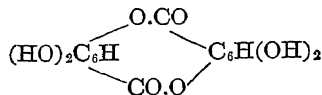
One of the unique features of the order, which attracts the attention of the outside world to its internal organization, is the annual memorial service for the dead of the order, held by every lodge on the first Sunday in December of each year. This is termed the "Sacred Session of the Order." The similar term "lodge of sorrow" is applied only to funerals. The membership in 1914 was upward of 410,000, and the society owned property and cash to the extent of about \$1,000,000. The benefits disbursed in 1913 were \$516,176. The *Elks Antler*, published monthly in New York City, is the order's official paper. Consult C. E. Ellis, *Authentic History of the Benevolent and Protective Order of Elks* (Chicago, 1910).

**ELKTON.** A town and the county seat of Cecil Co., Md., 50 miles northeast of Baltimore, on the Philadelphia, Baltimore, and Washington Railroad, and on the Elk River, at the head of navigation (Map: Maryland, H 1). It has pulp and textile mills, fertilizer works, a hosiery mill, and boat yards. Elkton was first settled in 1681 and incorporated in 1787. It has adopted the commission form of government. Pop., 1900, 2542; 1910, 2487.

**ELL** (AS. *eln*, Icel. *alin*, Goth. *aleina*, OHG. *elina*, *elna*, Ger. *Elle*; connected with Lat. *ulna*, Gk. *ὤλερν*, *ὀλενέ*, forearm). An obsolete measure of length. It was originally taken in some

vague way from the arm and hence has been used to denote very different lengths. The Latin *ulna* appears to have denoted sometimes the measure from the elbow to the tips of the fingers and sometimes that between the outstretched hands. The English ell, as a measure of cloth, is equal to five-quarters of a yard.

**ELLAGIC ACID**, *el-laj'ik as'id* (arbitrarily transposed from Fr. *galle*, gallnut, as being a derivative of gallic acid),  $C_{14}H_6O_8$ . A white crystalline substance contained in the bezoar stones found in the antelope and other animals. Its principal occurrence, however, is in tannin matters containing ellagitannin. It was discovered in oak galls by Chevreal in 1828. It may be prepared from divi-divi (*Cesalpinia coriaria*, Willd.) by boiling the tannin extract with dilute acids and recrystallizing the precipitated ellagic acid from pyridine. Löwe reproduced ellagic acid synthetically by oxidizing gallic acid. In 1909 Rupe showed that ellagic acid may be readily prepared by the addition of sodium nitrite to gallic acid dissolved in sulphuric acid. Ellagic acid plays a rôle of some importance in the tanning process. Its constitution is in all probability represented by the formula



**ELLAND**, *el'land*. A town in the West Riding of Yorkshire. It is in the Calder, 2½ miles south of Leeds (Map: England, E 3). Its chief industries are the manufacture of cottons, woollens, iron, iron-ore, and fire clay. Pop., 1901, 10,412; 1911, 10,076.

**ELLENBOROUGH, EDWARD LAW**, first **BARON (1750-1818)**. An English lawyer and jurist, Lord Chief Justice from 1802 to 1818. He was born at Great Salkeld, Cumberland, was educated at the Charterhouse and at Peterhouse College, Cambridge, was a fellow of Trinity, and studied law at Lincoln's Inn. He began to practice law as a special pleader in 1775, was called to the bar in 1780, and made a King's counsel in 1787. In the year 1788 he became leading counsel for Warren Hastings in his trial before the House of Lords. In 1793 he was appointed Attorney-General for the County Palatine of Lancaster, and as one of the crown attorneys assisted in many famous trials, including those of Lord George Gordon and Horne Tooke. In 1801 he was appointed Attorney-General in the County of Middlesex, was knighted, and was elected a member of the House of Commons. In April, 1802, he was appointed to succeed Lord Kenyon as Lord Chief Justice of England, at the same time being raised to the peerage under the title of Baron Ellenborough. His entering the ministry of "All the Talents" in 1806 was much criticized, the only precedent of a judge holding political office being that of Lord Mansfield. His fame as a legislator rests for the most part on the Ellenborough Act—since repealed—by which 10 new capital felonies were created. Although a man of great legal knowledge and sterling integrity, he was quick-tempered and of violent prejudices, characteristics which greatly affected his standing as a jurist. Originally a Whig, he had changed sides after the French Revolution. Consult Campbell, *Lives of the Chief Justices of England*, vol. iii (London, 1857).

**ELLENBOROUGH**, EDWARD LAW, first EARL OF (1790-1871). An English statesman, son of Baron Ellenborough. He was educated at Eton and at St. John's College, Cambridge, where he was a member of the Senate in 1809. In 1813 he married Lord Ellenborough's sister and entered Parliament. He was a member of the Privy Seal in the Duke of Wellington's administration (1828-29) and in 1841 was appointed Governor-General of India. His policy was displeasing to the directors of the East India Company, and he was recalled. The ministry, however, stood by him, and he was created an earl and a viscount. In the Derby administration of 1858 he was President of the Board of Control. Having permitted a dispatch to be made public in which he had administered a severe and taustic rebuke to Lord Canning, Governor-General of India, he was compelled to resign. He remained out of office until his death, though he continued to be the foremost orator in the House of Lords.

**ELLENRIEDER**, ɛl'en-rē'dēr, MARIE (1791-1863). A German portrait and historical painter, born at Constance. She studied at the Academy of Munich, under Einsle, the painter of miniatures, and completed her education at Rome, under Overbeck. She resided at Constance and in 1840 was appointed court painter to the Grand Duke of Baden. She belongs to the religious and romantic school of the Nazarenes, and painted chiefly portraits and altarpieces. Among the best are a "Virgin and Child" (1824); a "St. Felicitas," in possession of the King of England; "The Stoning of St. Stephen"; "Mary in a Bower of Roses," in the Museum of Karlsruhe, which possesses a number of her works. Her heads of women and children are graceful, but her color is gray, dull, and sombre. She also etched 24 plates after Overbeck, Rembrandt, Titian, and others.

**EL/LENSBURG**. A city and the county seat of Kittitas Co., Wash., 119 miles by rail east-southeast of Seattle, on the Northern Pacific and the Chicago, Milwaukee, and St. Paul railroads, and on the Yakima River (Map: Washington, E 4). Ellensburg contains a public library and a State normal school. The city is in an extensively irrigated region, which has valuable deposits of coal, iron, and gold, and produces live stock and dairy and orchard products. There are grist and saw mills, a glove factory, creameries, and a woolen mill. The electric-light plant and water works are owned by the city. Pop., 1900, 1737; 1910, 4209.

**EL/LENVILLE**. A village in Ulster Co., N. Y., 28 miles southwest of Kingston, on the New York, Ontario, and Western Railroad (Map: New York, A 1). Picturesquely situated in the midst of the Shawangunk Mountains, Ellenville is a popular summer resort. It has finely shaded streets and is near several places of interest, including Mount Moenahga, the Ice Caves, Sun Ray Spring, and many beautiful waterfalls. Its chief industrial establishments are manufactories of pocket cutlery, handkerchiefs, and shirt waists, and concrete stone and paint works. The village owns its water works. Pop., 1900, 2879; 1910, 3114.

**EL/LERY**, ROBERT LEWIS JOHN (1827-1908). An English astronomer, born at Cranley, Surrey. He was educated for the medical profession, but became interested in astronomy and meteorology. In 1851 he went to Australia, where two years later he erected an astronomical observatory at Williamstown, near Melbourne,

Victoria, and from 1856 to 1874 he conducted the geodetic survey of that colony. Under his direction the observatory founded by him (subsequently removed to Melbourne) published about 30 volumes of meteorological, and several volumes of astronomical, observations. He was one of the founders of the Royal Society of Victoria, the presidency of which he filled for 23 years. He retired from public life in 1895.

**ELLERY**, WILLIAM (1727-1820). A signer of the Declaration of Independence. He was born in Newport, R. I., and studied at Harvard in 1747, was a merchant for several years, then acted as naval agent for the Colony, and afterward practiced law. From 1776 to 1786, with the exception of 1782, he was a member of the Continental Congress, and served on the Marine Committee and the Board of Admiralty. He was Chief Justice of Rhode Island in 1785. In 1786 he became commissioner of the Continental Loan Office for Rhode Island, and from 1790 until his death was collector of customs for the district of Newport. Consult Sparks's *Library of American Biography*, vol. vi (Boston, 1836).

**ELLESHERE**, ɛlz'mēr, FRANCIS EGERTON, first EARL OF (1800-57). An English politician, second son of the Duke of Sutherland. He was born in London, studied at Eton and Christ Church, Oxford, entered the House of Commons in 1822 and spoke for free trade, and was Chief Secretary for Ireland from 1828 to 1830, when he became Secretary of State for War. In 1833 he assumed the name of Lord Francis Egerton, in lieu of his patronymic, Leveson-Gower, and in 1846 he was created Viscount Brackley and Earl of Ellesmere. In politics a Liberal Conservative, he spoke in behalf of free trade 20 years before Sir Robert Peel embraced the cause. He was a writer of graceful poems and plays; a translator of Goethe's *Faust*, of Schiller, of Körner, and of Dumas's *Henri III*; the author of a *Guide to Northern Archaeology* (1848); and a munificent patron of the arts. His valuable collection of pictures was placed by him in a gallery open to the public. He was lord rector of Aberdeen University (1841), president of the Royal Geographical Society, and a patron of Agassiz. His *Personal Reminiscences of the Duke of Wellington* was edited with a memoir by his daughter (New York, 1904).

**ELLESHERE LAND**. The southern part of the large body of land lying north of Jones Sound and west of northern Greenland, from which Ellesmere Land is separated by Smith Sound (Map: America, North, K 2). This land, with its fringing islands, forms the northernmost extension of the Arctic archipelago of North America. Ellesmere Land is an uninhabited region, almost entirely covered by glacial ice caps. It was first seen by William Baffin, in 1616. Up to 1899 it was thought to be separated from Grinnell Land, which lies to the north, by Hayes Sound; but the explorations of Peary in that year proved Hayes Sound to be a mere inlet of Kane Basin. The most extensive explorations are those of Otto Sverdrup (1898-1902), who discovered the unknown west coast and adjacent islands. Consult Sverdrup, *Four Years in the Arctic Regions* (2 vols., New York, 1904).

**EL/LET**, CHARLES (1810-62). An American engineer, born in Penn's Manor, Bucks Co., Pa. He began life as a surveyor and completed his engineering studies at the Ecole Polytechnique

in Paris. After serving as an assistant engineer on several railroads, he was appointed chief engineer of the James and Kanawha Canal. In 1841-42 he planned and constructed the wire suspension bridge across the Schuylkill at Fairmount, Pa., the first bridge of the sort to be built in America. He also built the suspension bridge at Niagara below the Falls and a large railway suspension bridge for the Baltimore and Ohio Railroad at Wheeling, W. Va. He was president of the Schuylkill Navigation Company in 1846 and became interested in steamboat construction. At the beginning of the Civil War he was commissioned a colonel of engineers by the Secretary of War and set to work to construct a fleet of rams after his own plans. With a squadron of nine rams he attacked a fleet of Confederate gunboats off Memphis, Tenn., on June 6, 1862, and sank and disabled several of them. During the engagement, however, he received a wound from the effects of which he died. Of his numerous writings, the most important are: *Physical Geography of the Mississippi Valley* (1851); *The Mississippi and Ohio Rivers* (1853); *Coast and Harbor Defenses* (1855); *The Army of the Potomac, and its Mismanagement* (1861).

**ELLET, ELIZABETH LUMMIS FRIES** (1818-77). An American author, born at Sodus Point, N. Y. Besides contributing to periodicals, she was the author of *The Characters of Schiller* (1842); *Women of the American Revolution* (1851); *Court Circles of the Republic*, with Mrs. R. E. Mack (1869).

**ELLICE** (əl'is) **ISLANDS**, or **LAGOON ISLANDS**. A low-lying group of islands in the Pacific, between lat. 5° and 11° S. and long. 176° and 180° E. (Map: Australasia, K 3). They are of coral formation, extending over more than 360 miles, but occupying an area of less than 15 square miles. Guano, yams, fruit, coconuts, and copra are the chief products. They belong to Great Britain, having formed, since 1892, an administrative dependency of the Fiji group. They were discovered in 1781 by Maurelle. Pop. (mainly Christianized Polynesians), 1911, 3084.

**ELLICHPUR**, əl'ich-poor. A town in the Amraoti District of Berar, British India, on the Bichan, 32 miles northwest of Amraoti (Map: India, C 5). It is a station of the Imperial Service troops and has manufactures of cotton goods and carpets. It is a large market for logs and lumber. Pop., 1891, 26,637; 1901, 26,082; 1911, 13,909.

**ELLCOTT, ANDREW** (1754-1820). An American civil engineer, born in Bucks Co., Pa. In 1789 he was appointed by Washington to survey the lands in western Pennsylvania and New York, near Lake Erie, and in the same year made the first accurate measurements of Niagara Falls and River. In 1790 he was engaged in surveying and laying out the new city of Washington, was appointed Surveyor-General of the United States in 1792, and in 1796 was one of the commissioners on the part of the United States to determine the boundary between this country and the Spanish territory. From 1801 to 1808 he was secretary of the Pennsylvania State Land Office, and from 1812 until his death held the chair of mathematics at the West Point Military Academy. He published a *Journal* in 1803.

**ELLCOTT, CHARLES JOHN** (1819-1909). An English clergyman and educator. He was born

at Whitwell, near Stamford, graduated at Cambridge (St. John's) in 1841, and for 10 years was rector of Pilton, Rutlandshire, but in 1858 became professor of New Testament exegesis in King's College, London, and in 1860 Hulsean professor of divinity at Cambridge. In 1861 he was made dean of Exeter and in 1863 Bishop of Gloucester and Bristol. When this see was divided in 1897, he became Bishop of Gloucester; he resigned his diocese in 1904. He became chairman of the New Testament Revision Committee in 1881. He defended the revision in various pamphlets, notably one (1882) in co-operation with Archdeacon Edward Palmer. His most important work is his *Critical and Grammatical Commentaries* on many of the Epistles (1854-58; 1887), and he edited a *Handy Commentary* on the New Testament (3 vols. and 13 vols., 1877-79). Among his other publications are: *Treatise on Analytical Statics* (1851); the (Hulsean) *Lectures on the Life of Our Lord Jesus Christ* (1860); and *Aids to the Faith* (1861), a reply to Jowett in *Essays and Reviews*.

**ELLCOTT CITY**. A city and the county seat of Howard Co., Md., 9 miles (direct) west of Baltimore, on the Patapsco River, and on the Baltimore and Ohio Railroad (Map: Maryland, F 2). It has manufactures of flour, cotton, silk, and woolen goods. Rock Hill College (Roman Catholic) was opened here in 1857, and the city contains a sanitarium. Founded in 1772, Ellicott City was incorporated in 1867. Pop., 1900, 1331; 1910, 1151.

**ELLIOT, ARTHUR RALPH DOUGLAS** (1846- ). An English lawyer and author, a son of the third Earl of Minto. He was educated at Edinburgh University and at Trinity College, Cambridge; was member of Parliament from 1880 to 1892 and from 1898 to 1906; and served as Financial Secretary to the Treasury during 1903. From 1895 to 1912 he was editor of the *Edinburgh Review*. His publications include: *Criminal Procedure in England and Scotland* (1878); *The State and the Church* (1881; 2d ed., 1899); *Life of the First Viscount Goschen* (1911).

**ELLIOT, DANIEL GIBAUD** (1835- ). An American ornithologist. He was born in New York and received an academic education. From 1856 to 1878 he traveled extensively in Europe, Africa, and Asia Minor, but afterward confined his travels and investigations principally to America. In 1896 he led an expedition into East Africa in the interest of the Field Museum, Chicago, and on his return became curator of zoölogy for that institution. In 1898 he had charge of an expedition sent under the same auspices to explore the Olympic Mountains in the State of Washington. He was the founder and a president of the American Ornithological Union and a vice president of the Zoölogical Society of France. He was decorated 10 times by European governments for work in scientific fields. His extensive scientific writings include treatises and monographs on *Family of the Grouse* (1865); *Family of the Pheasants* (1871-72); *Family of the Hornbills* (1877-82); *Birds of North America* (1897); *The Land and Sea Mammals of Middle America and the West Indies* (1894); *Wild Fowl of the United States and British Possessions* (1898); *North American Shore Birds* (1895); *Gallinaceous Game Birds of North America* (1897); *Synopsis of the Mammals of North America and the Adjacent Seas*



(1901); *Catalogue of Mammals in the Field Columbian Museum* (1906); *A Review of the Primates*, vols. i-iii (1913).

**ELLIOT, GILBERT.** See MINTO, EARL OF.

**ELLIOTSON, JOHN** (1791-1868). An English physician, born in London and educated at Edinburgh and Cambridge. In 1829 he delivered before the Royal College of Physicians his valuable Lumley lectures on diseases of the heart (published in 1830), and in 1831 he was called to the chair of clinical medicine of London University. The establishment of the University College Hospital, of which he became chief physician in 1834, was due chiefly to his influence, and in his practice there he may be said to have been the first to demonstrate the importance of clinical teaching. Auscultation and the use of the stethoscope were also introduced by him. Deeply interested in the study of mesmerism, he established, in 1849, a mesmeric hospital where hypnotic treatment is said to have been applied successfully. To him W. M. Thackeray dedicated his *Pendennis*. He was the founder and first president of the Phrenological Society and president of the Royal Medical Society of London. Besides numerous contributions to periodicals, he published a translation of Blumenbach's *Elements of Physiology* (2d ed., 1828) and wrote: *Cases of the Hydrocyanic or Prussic Acid* (1820); *Lectures on Diseases of the Heart* (1830); *Principles and Practice of Medicine* (1839); *Human Physiology* (1840); *Surgical Operations in the Mesmeric State without Pain* (1843).

**ELLIOTT, AARON MARSHALL** (1846-1910). An American Romance philologist, born at Wilmington, N. C. He graduated from Haverford College in 1866 and from Harvard in 1868 and also studied in France, Italy, Spain, Germany, and Austria. At Johns Hopkins University he served as an associate in Romanic languages (1876-84), associate professor (1884-92), and professor (1892-1910). He became known for his researches in mediæval French languages and gave special attention to the works of Marie de France. For seven years he was secretary of the Modern Language Association of America. In 1907 he was decorated with the cross of the Legion of Honor.

**ELLIOTT, CHARLES** (1792-1869). An American Methodist Episcopal clergyman. He was born in County Donegal, Ireland, and preached there for two years before emigrating to America in 1815. He was superintendent of missions among the Wyandot Indians, presiding elder of the Ohio district, professor of languages in 1827-31 at Madison College (Uniontown, Pa.), presiding elder of the Pittsburgh district, and editor of various Methodist periodicals. From 1856 to 1860 and again from 1864 to 1867 he was president of the Iowa Wesleyan University and professor of biblical literature. His reputation as a scholar rests chiefly upon his *Delineation of Roman Catholicism* (2 vols., 1841). Among his further publications are: *Treatise on Baptism* (1834); *Indian Missionary Reminiscences* (1850); *The Great Secession* (1852), a history of the division of the Methodist Episcopal church in 1845 on account of slavery; *South-western Methodism* (1868).

**ELLIOTT, CHARLES LOBING** (1812-68). An American portrait painter. He was born at Auburn, N. Y., and studied in New York City under Trumbull and Quidor. After practicing portrait painting in New York State for 10 years

he took up his residence in New York City in 1845 and the following year was elected to the National Academy of Design. Elliott was the best portraitist of his day, and although he never went abroad his technique is neither provincial nor uncertain. His method is mature, his drawing firm, his color fresh and clean, and his likenesses excellent, though somewhat lacking in sentiment. He is said to have painted over 700 portraits, mostly heads, as he had little idea of the composition of large canvases. Among his sitters were Fenimore Cooper, Fitz-Greene Halleck, Fletcher Harper, A. B. Durand (the Corcoran Gallery, Washington), and Governor Bouck (City Hall, New York). There are other portraits by him in the New York City Hall, the State Library at Albany, and four examples in the Metropolitan Museum, New York. He also painted figure pieces, including "Don Quixote" and "Falstaff," and one landscape, "The Head of Skaneateles Lake."

**ELLIOTT, EBENEZER** (1781-1849). An English poet, known as the Corn-Law Rhymers. He was born at Masborough, Yorkshire, England. In 1821 he entered the iron trade at Sheffield and was very successful and in 1841 retired to an estate which he had purchased at Great Thonghton, near Barnsley. His best productions are *The Village Patriarch* (1829), *The Splendid Village*, and the famous *Corn-Law Rhymes* (1831). Elliott followed Crabbe, but with more fire and depth of feeling, in depicting the condition of the poor as miserable and oppressed, tracing most of the evils he deplores to the social and political institutions of the country, especially to the Corn Laws. A new edition of his works, revised and edited by his son, Edwin Elliott, was published in London (1876). Consult Watkins, *Life, Poetry, and Letters of Ebenezer Elliott* (London, 1850), and a critical edition of the man by Thomas Carlyle in the *Edinburgh Review* (1832).

**ELLIOTT, EDWARD CHARLES** (1874- ). An American educator, born in Chicago. After graduating from the University of Nebraska in 1895, he studied at Jena and Columbia universities. From 1898 to 1903 he was superintendent of the Leadville (Colo.) schools, and at the University of Wisconsin he was associate professor of education in 1905-07, professor after 1907, and also director of the pedagogical seminar after 1909. He also conducted special investigations for the United States Bureau of Education in 1906-10, for the New York Board of Education in 1911-12, and for the State of Vermont in 1913. His publications include: *Some Fiscal Aspects of Public Education in American Cities* (1905); *State School Systems* (1904; 3d ed., 1910); *Legislation upon Industrial Education in the United States* (1910); *City School Supervision* (1914).

**ELLIOTT, SIR HENRY MEERS** (1808-53). An English historian. After finishing his studies at Oxford, at an early age he entered the service of the East India Company and was secretary to the Governor-General in 1847. Two years later he negotiated the important treaty with the native chiefs regarding the settlement of the Punjab and Gujarat. He died at the Cape of Good Hope on his way back to England in 1853. His principal literary productions are: *Supplement to the Glossary of Indian Terms*, of which only the first volume appeared (1846; enlarged ed. by Beames, 1869); *Bibliograph-*

*ical Index to the Historians of Mohammedan India*, vol. i (1849), a work in which the author enters upon an extensive biographical and critical discussion of more than 200 Arabic and Persian historians, but which was not completed; and the *History of India as told by its own Historians*, ed. by John Dowson (8 vols., 1866-77; a *Sequel* by Sir E. C. Bailey, 1886). This latter is a valuable contribution to the history of Mohammedan rule in India.

**ELLIOTT, HOWARD** (1860- ). An American railroad president, born in New York City. He graduated from Lawrence Scientific School (Harvard) in 1881. After serving in several less important capacities with the Chicago, Burlington and Quincy Railroad until 1887, he then became general freight and passenger agent of the St. Louis, Keokuk, and Northwestern Railway—a part of the Burlington System—and later he was general freight agent (1891-96) of the whole system, general manager (1896-1902), and second vice president (1902-03). He was president of the Northern Pacific Railway Co. from 1903 to 1913, and in the latter year succeeded Charles S. Mellen as president of the New York, New Haven, and Hartford; but he resigned this office before the end of the year and became chairman of the board of directors.

**ELLIOTT, JESSE DUNCAN** (1782-1845). An American naval officer. He was born in Maryland, was educated at Carlisle, Pa., studied law, and in 1804 entered the navy as a midshipman. In October, 1812, he captured two British brigs, the *Detroit* and the *Caledonia*, near Fort Erie (q.v.), the first naval success for the Americans on the Great Lakes. At the capture of York (now Toronto), in April, 1813, he commanded the *Madison*, and in the battle of Lake Erie, September, 1813, the *Niagara*, being second in command to Perry. His conduct during the battle was the subject for many years of considerable controversy. In October, 1813, he succeeded Perry in command of the Lake Erie fleet. He afterward commanded the sloop of war *Ontario* under Decatur during the war against Algiers in 1815, was raised to the rank of captain in 1818, and commanded the West India squadron and the Charlestown Navy Yard. In 1840, after having commanded the *Constitution* in the Mediterranean squadron for several years, he was tried by court-martial and was suspended from duty for four years. In October, 1843, however, he was restored to the service and was placed in command of the Philadelphia Navy Yard. For discussions of his conduct in the battle of Lake Erie, consult: Jarvis, *A Biographical Notice of Commodore Jesse D. Elliott* (Philadelphia, 1835); Burges, *Battle of Lake Erie, with Notices of Commodore Elliott's Conduct in that Engagement* (ib., 1839); Cooper, *Battle of Lake Erie* (Cooperstown, 1843); Bancroft, *History of the Battle of Lake Erie, and Miscellaneous Papers* (New York, 1891).

**ELLIOTT, JOHN** (1858- ). An American mural and portrait painter. He was born in England, on the Scottish border, of a well-known family, and studied at the Julian Academy under Carolus Duran, and at Rome under Villegas. One of his earliest and most characteristic decorative pieces is "The Vintage," a ceiling and frieze in the house of Mrs. Potter Palmer, Chicago. This was followed by a ceiling for the Boston Public Library (1894-1901), entitled "The Triumph of Time," decoratively treated, yet of great depth and airiness.

In 1908 he completed his greatest achievement, the mural painting "Diana of the Tides," in the New National Museum, Washington. His decorations are characterized by luminous color, subtle handling of light, and clever blending of the real and ideal. Elliott is also noted as a portrait painter, especially in red chalk, pastel, and silver point, in which mediums he displays a delicate and subtle technique. Among his best portraits are those of his mother-in-law, Julia Ward Howe, in red chalk (Metropolitan Museum, New York); King Humbert of Italy, in silver point (owned by Queen Margherita); Lord Ava; The Marquis of Winchester; and General Wauchope. His figure subjects include two versions of "Dante in Exile" (one owned by Queen Margherita) and a pastel study of Dante (Mrs. David Kimball), which has become world famous. His illustrations for fairy tales also deserve mention. For his distinguished services to the earthquake sufferers at Messina, he received medals from the Italian government and the American Red Cross Society.

**ELLIOTT, MAXINE** (1871- ). An American actress, born at Rockland, Me., daughter of Thomas and Adelaide Dermot. Her first serious rôle was as Felicia Umfraville, with E. S. Willard in *The Middleman*, in 1890. Afterward she played with Willard in *The Professor's Love Story* and other pieces. With Daly's company she went to London in 1895, playing in Shakespearean parts as well as in light comedy. In 1896 she joined N. C. Goodwin, with whom, in 1898, she played in Clyde Fitch's *Nathan Hale*. In 1898 she was married to Goodwin, and in 1900 they appeared with much popular success in H. V. Esmond's *When We Were Twenty-one*. In 1903 she appeared as a "star" in Clyde Fitch's *Her Own Way*. After this she continued to "star" successfully in various light comedies.

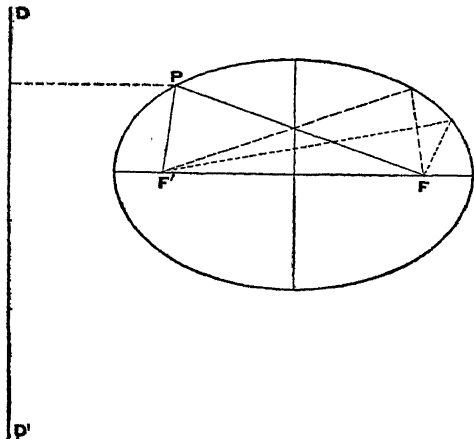
**ELLIOTT, SAMUEL MACKENZIE** (1811-73). An American physician, born at Inverness, Scotland. He was educated at the Royal College of Surgeons in Glasgow. In 1833 he went to the United States and continued his medical studies in Philadelphia and Cincinnati. In 1835 he settled in New York City and soon gained great reputation as an oculist. He served in the Civil War as lieutenant colonel of the Highland Guard and was wounded in the first battle of Bull Run. Subsequently he was brevetted brigadier general.

**ELLIOTT, SARAH BARNWELL** (?- ). An American novelist, daughter of Stephen Elliott (1806-66), first Bishop of Georgia. Her more noteworthy volumes of fiction are: *The Felmeres* (1879); *Jerry*, a pathetic story of "poor-white" life in the Tennessee mountains, originally published serially in *Scribner's Magazine*, later translated into German, and republished in Australia; *The Durket Sperret*, a realistic story also of the Tennessee mountaineer; *An Incident and Other Happenings* (1899); *The Making of Jane* (1901). She also wrote an excellent biography of *Sam Houston* (1900) for the "Beacon Biographical Series" and many short stories, chiefly of Southern life.

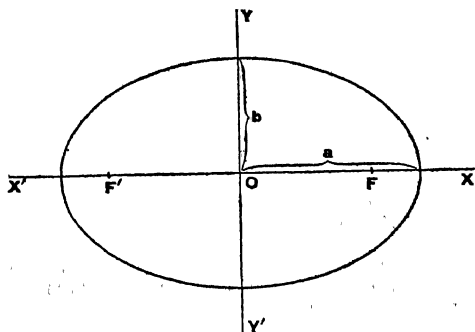
**ELLIOTT, STEPHEN** (1771-1830). An American naturalist. He was born at Beaufort, S. C., graduated at Yale in 1791, and was a member of the State Legislature from 1793 until 1812. He assisted in organizing the Literary and Philosophical Society of South Carolina and was for a time its president. He was also

one of the founders of the State medical college, in which for some years he was professor of natural history and botany. From 1812 to his death he was president of the Bank of the State. He published *The Botany of South Carolina and Georgia* (2 vols., 1821-24) and was for a time the editor of the *Southern Review*.

**ELLIPSE** (Lat. *ellipsis*, from Gk. ἔλλειψις, *elleipsis*, omission, from ἐλλείπειν, *elleipein*, to



omit, from ἐν, *en*, in + λείπειν, *leipein*, to leave). An important geometric figure, representing the approximate shape of the planetary orbits. It is one of the conic sections (q.v.) and received its name from Apollonius (q.v.). It is a curve of the second order and second class (see CURVE) and may be defined as the locus of a point (*P*), the sum of whose distances from two fixed points is constant. The two fixed points are called the foci (*F* and *F'*); the diameter drawn through them is called the major axis, and the perpendicular bisector of this diameter the minor axis. It is also defined as the locus of a point which moves so that the ratio of its distance from a fixed point, called the focus, to its distance from a fixed line (*DD'*), called the directrix, is constant and less than unity; the constant ratio is called the *eccentricity* of the ellipse and is equal to the ratio of the distance between the foci to the



major axis. The limit of the ellipse, as the eccentricity approaches 0 and the foci approach coincidence, is the circle. There are various contrivances for describing an ellipse, called *ellipsographs*, or *elliptic compasses*. The simplest method is to fix the two ends of a thread to

pins at the foci and make a pencil move in the plane, keeping the thread taut. The end of the pencil will trace an ellipse whose major axis is equal to the length of the thread. The Cartesian equation of the ellipse placed symmetrically with respect to the axis of coördinates

(q.v.) is  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ , *a*, *b* being the semimajor and semiminor axes respectively. The eccentricity is  $e = \frac{\sqrt{a^2 - b^2}}{a}$ . The polar equation of the

ellipse is  $r = \frac{P}{1 + e \cos \theta}$ , where the parameter  $P = \frac{b^2}{a}$ . The centre *O* bisects all chords passing through it; each diameter of a pair of conjugate (q.v.) diameters bisects all chords parallel to the other; and the focal chord parallel to the directrix is called the *latus rectum*. From the equation of the ellipse, by means of the integral calculus, its area is shown to be  $\pi ab$ . The length of its circumference is approximately

$$2\pi a \left( 1 - \frac{e^2}{2^2} - \frac{1.3e^2}{2^2 \cdot 4^2} - \frac{1.3^2 \cdot 5e^2}{2^2 \cdot 4^2 \cdot 6^2} - \dots \right).$$

There are several special kinds of ellipses, for the names and equations of which, consult Brocard, *Notes de bibliographie des courbes géométriques* (Bar-le-Duc, 1897).

**ELLIP'SIS** (Lat., from Gk. ἔλλειψις, *elleipsis*, omission). A term used in grammar and rhetoric to signify the omission of a word necessary to complete the expression or sentence in its usual form. The object of ellipsis is brevity and impressiveness. See SYNTAX, FIGURES OF.

**ELLIP'SOID** (from Gk. ἔλλειψις, *elleipsis*, ellipse + εἶδος, *eidos*, form). A kind of solid, bounded by a surface of the second order, the spheroid being a special case, as stated below. The latter has a peculiar interest because the form of the earth is spheroidal. The Cartesian equation of an ellipsoid referred to its centre as origin, and its axes as axes of coördinates (q.v.), is  $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ , where *a*, *b*, *c* are the semi-axes. By giving the value 0 successively to *x*, *y*, *z*, the equations of three ellipses are obtained, which are the sections of the ellipsoid, made by the respective coördinate planes. If any two of the quantities *a*, *b*, *c* are equal, one of the three sections is a circle, and the ellipsoid becomes an *ellipsoid of revolution*. The surface formed by the revolution of an ellipse about its major axis is called a *prolate* spheroid, and that formed by the revolution about the minor axis is called an *oblate* spheroid, the latter being the general form of the earth. The term is often applied to the solid inclosed by the surface above defined. Ellipsoids play an important part in the theory of inertia. If on an ellipse *l* through the origin *O*, a length *OP* be laid off, inversely proportional to the square root of the moment of inertia *I* of the line with respect to the given mass *m*, the locus of the point *P* will be a quadric surface called the *ellipsoid of inertia*, or *momental ellipsoid*, of the point *O*. The polar reciprocal (see POLE AND POLAR) of the momental ellipsoid with respect to a certain sphere is called the *ellipsoid of gyration*, or the *reciprocal ellipsoid*.

**ELLIP'TIC FUNCTIONS.** See FUNCTIONS.

**ELLIS**, ALEXANDER JOHN (1814-90). An English philologist and mathematician, born at

Hoxton, London, and educated at Eton and Trinity College, Cambridge. He was born under the surname Sharpe, but changed it to Ellis by royal license in 1825. He began the study of law in the Middle Temple, but gave it up for mathematics, first attracting attention by a translation of Ohm's *Geist der mathematischen Analysis* in 1847. It was as a phonologist and, however, that Ellis was best known. . . . himself with Sir Isaac Pitman, with whom he formulated a system of printing which he called "phonotypy," which added several new letters to the alphabet corresponding to sounds used in spoken language. His work formed the basis for all modern English phonetics in that he was the first to reduce this study to a science. His studies in phonology led him naturally to a study of philology, and he took high rank as an authority on both early English pronunciation and modern English dialects. His greatest work in this field was entitled *On Early English Pronunciation, with Special Reference to Shakspere and Chaucer*, which was published at intervals between 1869 and 1889. Another field in which Ellis achieved distinction was in the scientific theory of music, to the literature of which he contributed *The Sensations of Tone as a Physiological Basis for the Theory of Music* (1875), based on a German work by Helmholtz, and *The History of Musical Pitch* (1880). His other works include: *Horse Taming* (1842); *Phonetics* (1844); *A Plea for Phonetic Spelling* (1848); *On Glosik; a New Sistem on English Speling* (London, 1870); *English, Dyonisian, and Hellenic Pronunciations of Greek* (ib., 1876); *Logic for Children* (ib., 1882), which consists of two addresses; *Original Nursery Rhymes for Boys and Girls* (1848); *Algebra Identified with Geometry* (1874); *Practical Hints on the Quantitative Pronunciation of Latin* (1874); *Pronunciation for Singers* (1877).

**ELLIS, ALSTON** (1847- ). An American university president, born in Kenton Co., Ky. In 1865 he graduated from Miami University. Between 1867 and 1892 he was principal of schools at Covington and Newport, Ky., and superintendent of schools at Hamilton and Sandusky, Ohio; from 1892 to 1900 he was president of the State Agricultural College of Colorado and during most of this period also director of the Colorado Experiment Station at Fort Collins, Colo.; in 1901 he became president of Ohio University. He served as president of the Ohio Superintendents' Association in 1875, the Ohio Teachers' Association in 1888, the Ohio College Association in 1892-93, and the Ohio Association of Presidents and Deans in 1910-11. Besides many educational reports he is author of a *History of the Ungraded Schools of Ohio*.

**ELLIS, EDWARD SYLVESTER** (1840- ). An American writer, principally known for his boys' stories of adventure. He was born at Geneva, Ohio, and was educated at the New Jersey State Normal School. After teaching for several years, especially at Trenton, N. J., where he was principal of the high school and superintendent of schools, he devoted himself after 1876 exclusively to historical research and literary work. He is author of more than a dozen series of juvenile stories, comprising some 150 volumes, and of such writings as: *The Camp-Fires of General Lee* (1886); *The Indian Wars of the United States* (1892); *History of our Country* (1896); *Dewey and Other Naval Commanders*

(1899); *Low Twelve* (1908); *High Twelve* (1912); *Life of Thomas Jefferson* (1913).

**ELLIS, GEORGE EDWARD** (1814-94). An American historian and editor. He was born in Boston, graduated at Harvard College in 1833 and at Harvard Divinity School in 1836, spent three years in study and travel in Europe, and from 1840 to 1869, when he resigned, was pastor of the Harvard (Unitarian) Church, Charlestown, Mass. From 1857 to 1863 he was professor of systematic theology in the Harvard Divinity School. In 1864, 1871, and 1879 he was a Lowell Institute lecturer and for a number of years was editor of the *Christian Register* and later of the *Christian Examiner*. He was an overseer of Harvard College in 1850-54 and in 1885 was elected president of the Massachusetts Historical Society. He published: *Sketches of Bunker Hill and Monument* (1843; 4th ed., 1846); *John Mason* (1844); *Anne Hutchinson* (1845); *William Penn* (1847); *Half Century of the Unitarian Controversy* (1857); *The Aims and Purposes of the Founders of Massachusetts and their Treatment of Intruders and Dissentients* (1869); *Memoir of Sir Benjamin Thompson, Count Rumford* (1871); *History of the Battle of Bunker Hill* (1875); *The Red Man and the White Man in North America* (1882); *The Puritan Age and Rule in the Colony of the Massachusetts Bay, 1629-1685* (1888). He wrote chapters for the *Memorial History of Boston* (1881) and for Winsor's *Narrative and Critical History of America* (1886). Consult the memoir by O. B. Frothingham in *Proceedings of the Massachusetts Historical Society* for May, 1895.

**ELLIS, SIR HENRY** (1777-1869). An English antiquarian, born in London and educated at St. John's College, Oxford. He held a sublibraryship in the Bodleian at Oxford for a few months and was then (1800) appointed to a similar position in the British Museum, where he was chief librarian from 1827 to 1856, when he retired. In 1833 he was knighted by William IV. He edited Brand's *Popular Antiquities* (1813) and several volumes for the Camden Society, published a valuable collection of *Original Letters Illustrative of English History* (11 vols., 1824-46), and wrote an *Introduction to Domesday Book* (2 vols., 1833).

**ELLIS, (HENRY) HAVELOCK** (1859- ). An English criminologist, born at Croydon, Surrey, and educated for a medical career at St. Thomas's Hospital. After teaching for several years in Australia he returned to England in 1880, where he became known as a writer. He wrote: *The Criminal* (1890; 4th ed., 1910); *Man and Woman: A Study of Human Secondary Sexual Characters* (1894; 4th ed., 1904); *A Dialogue in Utopia* (1900); *The World of Dreams* (1911); *The Task of Social Hygiene* (1912); and "Studies in the Psychology of Sex," a series . . . . . up to 1914, these six volumes: *Sexual Modesty* (1897), *The Evolution of Modesty* (1899; 3d ed., 1910), *Analysis of the Sexual Impulse* (1903; 2d ed., 1913), *Sexual Selection of Man* (1905), *Erotic Symbolism* (1906), and *Sex in Relation to Society* (1910).

**ELLIS, JOB BICKNELL** (1829-1905). An American botanist, born at Potsdam, N. Y., and educated at Union College. His publications include *North American Fungi*, with B. M. Everhardt (1892), and *North American Fungi* (1878-93). He was an editor of the *Journal of Mycology* from 1885 to 1888.

**ELLIS, JOHN VALENTINE** (1835– ). A Canadian journalist and legislator. He was born in Halifax, Nova Scotia, and was educated there in the public schools. He worked in a printer's office for some years and in 1857 went to St. John, New Brunswick, where he became a reporter. In 1862 he brought out the *St. John Globe*, which he thereafter edited and published. Entering politics in 1882, he sat for five years as the Liberal member for St. John in the New Brunswick Legislature. In 1887–91 he represented St. John in the House of Commons, and in connection with his election there were court proceedings involving him for contempt of court, for which he underwent imprisonment and was sentenced to pay a fine. The outcome of the proceedings increased his popularity, and the fine was paid by public subscription. In 1896–1900 he was again a member of the House of Commons, but in the latter year he was appointed a member of the Dominion Senate. In 1911 he was elected chairman of the Senate Committee on Debates, and also president of the Natural History Society of New Brunswick. He published several political pamphlets.

**ELLIS, MINA A.** (1875?– ). A Canadian explorer and author. She was born at Bewdley, Ontario, and graduated at the Brooklyn (N. Y.) Training School for Nurses. Subsequently she was assistant superintendent of the S. R. Smith Infirmary, Staten Island, and superintendent of the Virginia Hospital, Richmond, Va. In 1901 she married Leonidas Hubbard, a journalist and explorer who perished in Labrador in 1903. After his death she organized an expedition which in 1905 successfully crossed the north-eastern part of the Labrador Peninsula (now the District of Ungava, Province of Quebec) with the object of completing Hubbard's work, and during the journey made many interesting discoveries. She was the first white person to cross the Great Divide between the Naskaupi and George rivers. On returning to the United States she published an account of her journey in *The Bulletin of the American Geographical Society*; also a volume, *A Woman's Way through Unknown Labrador* (1908).

**ELLIS, ROBINSON** (1834–1913). An English classical scholar, born at Barming. He entered Balliol College, Oxford, and took the degree of B.A. in 1857; became fellow of Trinity College in 1858; received the M.A. degree in 1859; was made professor of Latin in University College, London, 1870; in 1883–93 was University reader in Latin literature, and in 1893 became Corpus professor of Latin literature, Oxford. He edited or wrote: *Catulli Veronensis Liber*, etc. (1878); *Ovid, Ibis* (1881); "Glosses on Apollinaris Sidonius," *Anc. Oxon., Class. Series*, 1, 5 (1885); *Avianus* (1887); *Orientii Carmina*, vol. xvi in the "Corpus Scriptorum Ecclesiasticorum" (1888); *Velleius Paterculus* (1898); *Afina* (1900); *Noctes Manilianae* (1891); *Appendix Vergiliana* (1907); and *The Annalist Licinianus* (1908). He contributed largely to the learned periodicals. He made also a translation of *Catullus* in the metres of the original (1871). His *Commentary on Catullus* (Oxford, 1876; 2d ed., 1889) took rank at once as a masterpiece of erudition and a first-hand study of all the sources of our knowledge of Catullus. For a notice of his work, with a partial list of his writings, consult Gildersleeve in *American Journal of Philology*, vol. xxxiv,

pp. 494–496 (1913). Consult also *The Classical Review*, vol. xxvii, pp. 286–287 (1913).

**ELLIS, WILLIAM** (1794–1872). An English missionary. He was born in London, Aug. 29, 1794. In 1816 he went to the South Pacific as a missionary of the London Missionary Society. In Tahiti he set up the first printing press in the South Sea Islands. From 1831 to 1841 he was foreign secretary of the London Missionary Society. From 1847 till his death he was pastor of the Congregational church at Hoddesdon, near London. In 1853 Mr. Ellis was sent to Madagascar by the London Missionary Society to investigate the condition and prospects of the Christians in that island. He afterward made two other visits to the island, the last time remaining four years (1861–65). He died at Hoddesdon, June 9, 1872. Mr. Ellis's works include: *Narrative of a Tour through Owhyhee [Hawaii]* (1826); *Polynesian Researches* (1829); *History of Madagascar* (1838), compiled from government papers and reports of missionaries; *Three Visits to Madagascar* (1858); *Madagascar Revisited* (1867); *The Martyr Church [of Madagascar]* (1870). These works are all standard authorities for the countries of which they treat. Consult the *Life* by his son, J. E. Ellis (London, 1873).—**SARAH STICKNEY ELLIS**, Mr. Ellis's second wife, was a voluminous writer and zealous worker in the interests of temperance reform, education, and efforts to improve the condition of young women of the lower classes. For many years she conducted a school for girls (Rawdon House) at Hoddesdon. She wrote: *The Poetry of Life; The Women of England* (1838); *The Young Ladies' Reader* (1845); *Rawdon House* (1848); and many other volumes of like character.

**ELLIS, WILLIAM** (1828– ). An English physicist and astronomer. He was born in Greenwich and in his teens entered the employ of the Royal Observatory, where in 1856–74 he was in charge of the chronometric and electric branch and in 1875–93 of the magnetical and meteorological department. His studies of terrestrial magnetism were particularly important.

**ELLIS, WILLIAM HODGSON** (1845– ). A Canadian physician and chemist. He was born in Bakewell, Derbyshire, England, but came to Canada in his youth and was educated at Toronto University, where he graduated in 1867. In 1866, during the Fenian Raid, he served with the Queen's Own Regiment at Ridgeway. He afterward studied medicine at Toronto University and in Great Britain. Returning to Toronto, he was appointed professor of chemistry in Trinity Medical School and lecturer on chemistry in Trinity University. His next position was that of instructor in chemistry in the Provincial College of Technology. In 1887 he was appointed professor of applied chemistry in the School of Practical Science, Toronto, and in 1900 he became professor of toxicology in Toronto University. He was also given the position of official analyst, inland revenue, Toronto. He was twice elected president of the Canadian Institute, and in 1906 was elected president of the local section of the Chemical Industries Society. He acquired a high reputation as a chemist and analyst.

**ELLIS, WILLIAM THOMAS** (1873– ). An American journalist and author. He was born at Allegheny, Pa., and was educated in the public schools. Until 1894 he served on the

staffs of Philadelphia newspapers, and afterward he was editor of the *International Christian Endeavor* organ (1894-97) and of *Forward* (1897-1902). From 1903 to 1908 he was an editorial writer for the *Philadelphia Press*. In 1906-07 and 1910-11 he made world tours for a newspaper syndicate, investigating social conditions in foreign countries. After 1897 he wrote syndicate Sunday-school lessons, and he also contributed to the *Continent* and other religious magazines. He became known as a frequent lecturer before religious bodies and as one of the founders of the Presbyterian Brotherhood. He is also author of *Men and Missions* (1909) and *Foreign Missions through a Journalist's Eyes*.

**ELLIS ISLAND.** A small island in the northern part of upper New York Bay, a mile southwest of the Battery (Map: Greater New York, C 6). It was sold by New York State to the United States in 1808, and for many years was used as a powder magazine. In 1891 it was made an immigrant station. The present buildings were erected in 1897, when the original structures were burned.

**ELLISON, PRICE** (1862- ). A Canadian legislator and administrator. He was born and educated in England, but came to Canada in early manhood and took up farming and ranching in British Columbia, becoming the largest wheat grower in that province. He entered politics in 1898 as a Conservative member of the British Columbia Legislature, and in 1909 was appointed Minister of Lands and Works in the Cabinet of Sir Richard McBride (q.v.). In 1910 he became Minister of Finance and Agriculture, and in 1912 a member of the Royal Conservation Commission.

**ELLISSEN, ELLÉSEN, ADOLF** (1815-72). A German philologist and literary historian, born at Gartow, and educated at the universities of Göttingen and Paris. From 1849 to 1855 he was a member of the second chamber of the Hanoverian Parliament, of which he became President in 1854. His *Tee- und Asphodelosblüten* (1840), a metrical translation of Chinese and modern Greek poems, is unique. A somewhat similar production entitled *Versuch einer Polyglotte der europäischen Poesie*, vol. i (1846), is a valuable contribution to literary history. His *Analekten der mittel- und neugriechischen Litteratur* (5 vols., Leipzig, 1855-62) was the most complete work of its kind for many years after its publication. As a translator he was very successful, being principally known for his versions of Montesquieu's *Esprit des Lois* and of Voltaire's selected works (1844-46). His study on *Voltaire als politischer Dichter* is still considered an important contribution.

**ELLISTON, ROBERT WILLIAM** (1774-1831). A noted English actor. He was born in London, the son of a watchmaker, and was educated at St. Paul's School at the expense of a scholarly uncle. He ran away from home, however, in 1791, and joined a theatrical company at Bath, making his first appearance, in a minor part, in that same year. In 1793 he was highly successful as Romeo. Beginning in 1796, he appeared occasionally in London, at the Haymarket and Covent Garden theatres, while engaged also at Bath and in the management of several playhouses in provincial towns. From 1804 to 1809 he was a member of the Drury Lane Company, but after the theatre was burned opened the

Surrey Theatre, returning to Drury Lane in 1812, where he took leading parts. He became lessee and manager of Drury Lane in 1819, opening it himself as Rover in *Wild Oats*, and later presenting Kean, Macready, and other great actors of his time, but retired a bankrupt in 1826. Subsequently he played at the Surrey Theatre, but his dissipated habits of long standing prevented him from regaining his old prestige, and he died of apoplexy two weeks after his last appearance as Sheva in *The Jew*. Elliston ranked among the great actors of his time, but was even more naturally remarkable as a comedian. He was the author of two plays, *The Venetian Outlaw* and (in collaboration) *No Prelude*, in which he appeared himself. For his life, consult: G. Raymond (London, 1848 and 1857); Oxberry, *Dramatic Biography* (London, 1826); *Actors and Actresses of Great Britain and the United States*, ed. by Matthews and Hutton, vol. ii (New York, 1886).

**ELLO'RA.** A ruined town in the dominions of the Nizam, not far from the city of Dowlatabad, in lat. 20° 2' N. and long. 75° 13' E. It is celebrated for its wonderful rock-cut temples, of which there are 19 large ones, partly of Brahman and partly of Buddhist origin. The largest is the Brahman Dumnar Lena, cruciform in plan, measuring 150 feet each way. The amalaka, or melon-capituled columns, of these caves are a noticeable feature. Besides the caves there are monolithic temples hewn bodily out of the rock. The most beautiful is the Brahman temple known as the Kailasa. At its entrance is an antechamber 138 feet wide by 88 deep, with numerous rows of pillars. From this a bridge leads into a great rectangular colonnaded court, 247 feet in length and 150 broad, in the centre of which stands the temple itself, a vast mass of richly carved rock, adorned with four rows of pilasters, with colossal elephants beneath. The interior is about 103 feet long, 56 broad, and 17 high, but the entire exterior forms a pyramid 100 feet high and is overlaid with sculpture. In the great court are numerous ponds, obelisks, colonnades, sphinxes, and on the walls thousands of mythological figures of all kinds, from 10 to 12 feet in height. The antiquity and religious character of the Brahman temples, authorities are not agreed; but at all events they must be subsequent to the epic poems *Ramayana* and *Mahabharata*, because they contain representations taken from these poems. Ferguson assigns the Kailasa to the ninth century; the Buddhist caves are much earlier. Consult Ferguson and Burgess, *The Cave Temples of India* (London, 1880).

**ELLS, ROBERT WHEELOCK** (1845-1911). A Canadian geologist. He was born in Cornwall, Nova Scotia, and was educated at Acadia University and at McGill, where he graduated in 1872. In the same year he joined the Geological Survey, and he continued in its service for more than 25 years, becoming senior geologist. His reports on the general resources of Nova Scotia, Prince Edward Island, Quebec, and the Northwest Territories were published in the annual volumes of the Geological Survey. He was elected a fellow of the Royal Society of Canada and a fellow of the American Geological Society.

**ELLSWORTH.** A city, port of entry, and the county seat of Hancock Co., Me., 30 miles



southeast of Bangor, on the Maine Central Railroad (Map: Maine, D 4). It is at the head of navigation on the Union River and has an extensive trade in lumber and shipbuilding interests, also manufactures of lumber, shoes, carriages, sails, and gasoline engines. Abundant water power is supplied by the river, which is spanned by several bridges at this point. The principal public buildings include the courthouse, customhouse, city hall, and a public library. A large United States fish hatchery is located here. Ellsworth was settled in 1763, incorporated in 1800, and chartered as a city in 1869. The government is vested in a mayor and a board of aldermen. The city owns its water works and electric-light plant. Pop., 1900, 4297; 1910, 3549.

**ELLSWORTH, EPHRAIM ELMER** (1837-61). An American soldier. He was born in Mechanicsville, N. Y., but early removed to Chicago, where he studied law and took charge of a company of cadets which he brought to a fine degree of efficiency and with which he toured the country in the summer of 1860. He became a friend of Abraham Lincoln, whom he persuaded to create a bureau of militia in the War Department. Lincoln gave Ellsworth a lieutenant's commission preliminary to putting him in charge of the militia bureau. He was dangerously sick in the spring of 1861, but in April organized a Zouave regiment (Ellsworth's Zouaves) from among the volunteer firemen of New York and became its colonel. He took part in the first general movement of the Federal forces into Virginia, but at Alexandria, on May 24, was shot dead by a hotel keeper from whose building he had just torn away a Confederate flag. In the North he was regarded as the first martyr to the cause of the Union. He was buried, with imposing military ceremonies, from the White House, in Washington, by special order of President Lincoln.

**ELLSWORTH, OLIVER** (1745-1807). An American statesman and jurist, born at Windsor, Conn., where his family had been settled since 1665. He studied at Yale and at Princeton, where he graduated in 1766. He studied theology for a year, but gave it up for law. Admitted to the Connecticut bar in 1771, he represented the town of Windsor in the General Assembly of Connecticut from 1773 to 1775 and was soon afterward chosen a member of the Pay Table, a commission having control of expenditure for military purposes during the Revolution. He became State's attorney in 1777 and was a member of the Continental Congress from 1778 to 1783 and was a member of the Council of the Governor of Connecticut (1780-85) and a judge of the State Superior Court (1785-89). In 1787, with Roger Sherman and William Samuel Johnson, he was chosen to represent his State in the Constitutional Convention at Philadelphia, where he distinguished himself by his activity and sound judgment. At the time when disagreement seemed certain on the question of representation, he, with Roger Sherman, proposed what became the basis of the national legislative system. This measure, known as the Connecticut Compromise, provided that the Federal legislature consist of two houses—the upper equally representative of the States, the lower composed of delegations proportioned according to population. On the organization of the

national government, in 1789, he was elected one of the first United States Senators from Connecticut and served in that capacity until 1796. In the Senate he was looked upon as leader of the Administration party and as the personal spokesman of President Washington. Ellsworth's greatest and most lasting service to the United States government was in connection with the establishment of the Federal judiciary. As chairman of the Senate Committee on the Judiciary, he drew up the bill which organized the entire system of Federal courts practically as they exist to-day. As leader of the Federalists in the Senate, he suggested to President Washington the plan of sending John Jay to England in 1794 to negotiate a new treaty with Great Britain; and it was Ellsworth's influence, in the face of violent opposition, that brought about the Senate's approval of the treaty after it had been drawn up. In 1796, by President Washington's appointment, he became Chief Justice of the Supreme Court of the United States, serving until 1799, when President John Adams sent him, with William R. Davie (1756-1820) and William Vans Murry (1726-1803), as commissioner to adjust the numerous disputes between the United States and France. The negotiations, carried on almost entirely by Ellsworth, terminated with the signing of a treaty whereby France conceded a recognition of the rights of neutral vessels, promised the return to citizens of the United States of all ships captured by France, and provided for freedom of commerce between the two countries. After a year in England, during which time, because of failing health, he resigned the chief justiceship (1800), he returned to America. From 1803 until his death he was a member of the Governor's Council in Connecticut, and on the reorganization of the Connecticut judiciary, early in 1807, was appointed Chief Justice of that State, but died before entering upon his duties. Consult W. G. Brown's *Oliver Ellsworth* (New York, 1905) and an excellent brief résumé in F. G. Cook's "Oliver Ellsworth and the Federation," *Atlantic Monthly*, vol. lxxxix, pp. 524-537 (April, 1902).

**ELLWANGEN**, ɛl'wäng-en. The capital of the Circle of Jagst, Württemberg, Germany, on the Jagst, 55 miles northeast of Stuttgart (Map: Germany, D 4). It is situated amid beautiful valley scenery, on the slope of a hill crowned by the Hohen-Ellwangen Castle. The Romanesque Stifteskirche, dating from 770, is its most interesting building. In the vicinity are the mineral baths of Schrezeim. It has a high school, a gymnasium, and an agricultural school. Its manufactures include leather, envelopes, drumheads, and shafting. It is a busy wool market. Ellwangen was the capital of a Benedictine principality of 140 square miles until 1802. Pop., 1900, 4747; 1910, 4722.

**ELLWOOD, CHARLES ABRAM** (1873- ). An American sociologist, born near Ogdensburg, N. Y. He graduated from Cornell University in 1896 and also studied at the universities of Chicago (Ph.D., 1899) and Berlin. After spending one year at the University of Nebraska as lecturer and instructor he was appointed professor of sociology at the University of Missouri in 1900. He became advisory editor of the *American Journal of Sociology* and associate editor of the *Journal of Criminal Law and Criminology* and was president of the Mis-

souri Confederate Charities in 1904. In addition to monographs and special articles on social psychology, he is author of *Sociology and Modern Social Problems* (1910) and *Sociology in its Psychological Aspects* (1912; Fr. trans., 1914).

**ELLWOOD, THOMAS** (1639-1714). An English writer, born at Crowell, Oxfordshire. He joined the Quakers, and his zeal for the sect and denunciation of the Established church brought upon him much persecution. He himself was equally intolerant of any division in the Quaker ranks. He was an intimate friend of Milton, and his comment upon reading the manuscript of *Paradise Lost* suggested to the poet the idea of *Paradise Regained*. Ellwood was the author of a number of polemical works, among them *Forgery no Christianity* (1674); two tracts attacking Thomas Hicks the Baptist; *The Foundation of Tithes Shaken* (1678); *Sacred Histories of the Old and New Testaments* (1709); and an *Autobiography* (1714).

**ELLWOOD CITY.** A borough in Lawrence Co., Pa., 30 miles northwest of Pittsburgh, on the Baltimore and Ohio, the Pittsburgh and Lake Erie, and the Buffalo, Rochester, and Pittsburgh railroads, and on Connoquenessing Creek (Map: Pennsylvania, A 5). It is in a coal-mining district and has large steel-tube mills, steel-car works, building-stone and limestone quarries, foundries and machine shops, iron-works, and manufactories of wire products, metal packings, etc. Pop., 1900, 2243; 1910, 3902.

**ELM.** A village and health resort in the Canton of Glarus, Switzerland, situated 10 miles southeast of Glarus, in a valley 3000 feet above sea level, surrounded by the high peaks of the Sardon Alps (Map: Switzerland, D 2). On Sept. 11, 1881, the town was buried under an avalanche, which killed 114 people. Pop., 1900, 914; 1910, 908.

**ELM** (AS., OHG. *elm*, Ger. *Ulme*, elm, ultimately connected with Lat. *ulmus*, Ir. *leamh*, elm), *Ulmus*. A genus of trees of the family *Urticaceae*, natives of temperate climates. The serrated leaves have unequal sides, and the small flowers which grow in clusters appear before the leaves unfold. One of the most important species is the English elm, *Ulmus campestris*, a tree of 60 to 80 feet in height, with ovate-elliptical, doubly serrated leaves, and almost sessile flowers. The tree is found all over Europe, also in the west of Asia and north of Africa, and introduced into America, and is extensively planted as a street tree. The wood, which is compact and durable, especially in water, is used for a great variety of purposes by wheelwrights, machine makers, ship and boat builders, etc. It is also prized by joiners for its fine grain and the mahogany color which it readily assumes on the application of an acid. It is reckoned superior to the wood of any other species of elm. The bark is used in dyeing and in sugar refining and in times of scarcity has been used in Norway for grinding into meal and mixing in bread, which has a less disagreeable taste than that made from meal mixed with fir bark. The inner bark is used medicinally in cutaneous diseases; it is mucilaginous and has a bitter, astringent taste. The elm balsam (*beaume d'orme*), which was formerly in great repute, is a brownish substance, which is found in dried galls of the elm leaves in the south of Europe, Persia, etc. From these galls in an

earlier stage flows a clear, viscid, sweetish liquid called elm water (*eau d'orme*), which is used for washing wounds, contusions, and sore eyes. The elm is one of the principal timber trees of the British Isles, is most extensively planted, and is a chief ornament of English scenery. The cork-barked elm, a variety of *Ulmus campestris*, is distinguished by the corky wings of the bark of the branches. It is taller than *Ulmus campestris*, of more spreading habit, with much larger leaves, and is a common European tree. The Dutch cork-barked elm is generally considered a variety of *Ulmus campestris*. It has a still more corky bark, still larger leaves, is of very thick growth, but its wood is very inferior. The broad-leaved, or wych, elm (*Ulmus montana*, or *scabra*), a tree of very quick growth, is the only species that can with certainty be regarded as indigenous to Scotland. It has rough broad leaves, a stem less upright than that of the English elm, and large spreading branches. The wood is used for all the purposes of the English elm. Protuberances of gnarled wood are not infrequently produced, which are finely knotted and richly veined; they are much esteemed for veneering and are sometimes very valuable. Varieties of this species are known as the giant elm and Chichester elm. The smooth-leaved elm (*Ulmus glabra*), a native of Europe, is distinguished by much smaller leaves. It is by some regarded as a variety of *Ulmus montana*. Another variety of this species, called the Huntingdon elm, is much esteemed. The Cornish elm (*Ulmus stricta*), now considered a form of *Ulmus campestris*, found in the southwest of England, is remarkable for its rigid, erect, and compact branches. *Ulmus pedunculata*, a continental species with a large spreading head and smooth bark, is distinguished also by the long stalk of its flowers and its ciliated fruit. The American, or white, elm (*Ulmus americana*), which attains its loftiest stature between lat. 42° and 46° N., is a . . . tree, sometimes 120 feet in height. The trunk reaches 60 or 70 feet before it separates into branches, and the widely diffused pendulous branches float gracefully in the air. It is one of the finest street and park trees. In New England it is highly prized for this purpose. There are a number of famous elm trees, among them the Washington elm (q.v.), at Cambridge, Mass., and the old elm on Boston Common. The timber is used for agricultural implements, wagon hubs, saddletrees, and cooperage. The red, or slippery, elm (*Ulmus fulva*) is also common in the basin of the Mississippi as far south as lat. 30° and in western Canada and New England. It attains a height of 50 or 60 feet. The wood is more valuable than that of the white elm, but inferior to the English elm. The leaves and bark yield an abundant mucilage, which is bland and demulcent and esteemed a valuable remedy in catarrh, dysentery, and other complaints. The wahoo, or winged elm (*Ulmus alata*), is a small tree, found from lat. 37° to Florida, Louisiana, and Arkansas, and is remarkable for the branches being furnished on two opposite sides with wings of cork. The wood is fine-grained, compact, and heavy. The cork, or rock, elm (*Ulmus racemosa*), a larger species, attaining a height of 100 feet and a diameter of 3 feet, ranges from western New England to Minnesota and southward. The wood of this species excels in its strength, toughness, flexibility, and durability.

TYPICAL ELM TREES



AMERICAN ELM (showing variable habit of growth in New England).



In China is found a species of elm, the leaves of which bear galls used in tanning and dyeing.

The name "Spanish elm" is given in the West Indies to a tree also called Bois-de-Chypre (*Cordia gerascanthus*), of the family Boraginaceae, the timber of which is valuable; also to *Hamelia ventricosa*, of the family Rubiaceae, the timber of which is known to cabinetmakers as princewood. The water elm (*Planera aquatica*) is a tree 30 to 50 feet high, occurring from North Carolina to Kentucky, Missouri, and southward. The name elm is applied in Australia to two timber trees, *Aphananthe philippinensis* of the family Urticaceae, and *Duboisia myoporoides* of the family Solanaceae. For illustrations, see Plates of DICOTYLEDONS, EDELWEISS, and FLOWERS. See ELM INSECTS.

**ELMACIN**, ʔVmā-kān (also ELMACINUS, or ELMAKYN), GEORGE (1223-c.74). An Arabian Christian historian, known in the East as Ibn-Amid. He was successively ketib (or secretary) to the court of the sultans of Egypt and (from 1238) secretary to the Council of War. He wrote a history of the Saracens, extending from the time of Mohammed to 1117. The work appeared at Leyden in Arabic and Latin in 1625 and was afterward translated into French as *L'histoire mahométane* (Paris, 1657).

**ELMALU**, ʔl-mā'loo, or **ALMALEE** (Turkish for "the place of apples"). A town in Asiatic Turkey, in the Vilayet of Konieh, about 45 miles from the coast (Map: Turkey in Asia, A 3). It lies picturesquely surrounded by mountains on all sides except the southwest and has flour mills, tanneries, and a lively trade. Its population is estimated at from 3000 to 4000.

**ELMAN**, MISCHA (1892- ). A distinguished Russian violinist, born at Talnoje. He showed such precocious and remarkable talent that when he was six years old his father took him to Odessa, where he studied four years with Fidelmann, a pupil of Brodsky. In 1902 Leopold Auer (q.v.) heard him and was so much impressed that he prevailed upon the Czar to suspend the rule barring pupils of the Jewish faith from the Imperial Conservatory of St. Petersburg. Here Elman continued his studies for two years under Auer with such success that at his début in 1904 he was unanimously acclaimed as a violinist of the first rank. His subsequent tours of Germany were a succession of triumphs. He visited the United States in 1908 and proved such an attraction that he was heard again with unabated enthusiasm in 1911, 1912, 1913, and 1914. His talent for the violin amounts to positive genius. His tone is large and powerful, his technic stupendous and unerring, his conception and interpretation those of the mature artist.

**EL MEKHEIR**, or **EL MESHERIF**. See BÉRBER.

**ELMENDORF**, THERESA HUBBELL (WEST) (1855- ). An American librarian, born at Pardeeville, Wis. She graduated from Miss Wheelock's Seminary, Milwaukee, Wis., in 1874. In 1896 she married Henry Livingston Elmendorf (died 1906). From 1880 to 1896 she was deputy librarian and librarian of the Milwaukee Public Library and after 1906 vice librarian of the Buffalo Public Library. She was president of the New York Library Association in 1903-04 and of the American Library Association in 1911-12—the first woman to hold that office. She served as editor of the *American Library*

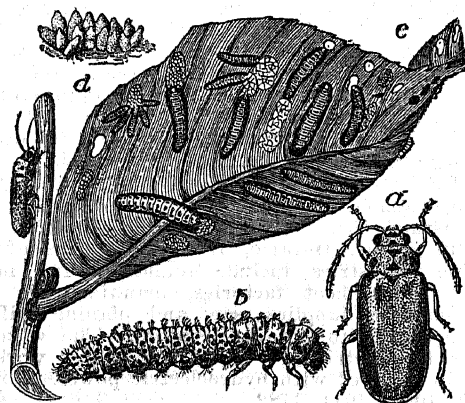
*Association Catalogue* and published several articles in library periodicals.

**ELMES**, ʔlmz, HARVEY LONSDALE (1813-47). An English architect, born at Chichester, the son of James Elmes (1782-1862), a well-known architect and author of his time. In 1836 he was successful among 86 in competition for the design of St. George's Hall, Liverpool. He was likewise successful in a subsequent competition for the design of the assize courts in the same city, and when it was decided to include the hall and the courts in one building he prepared a new design. The work of construction, begun in 1841, was superintended by Elmes until ill health obliged him to withdraw in 1847, when he was succeeded by C. R. Cockerell. The Collegiate Institution at Liverpool and a county asylum at West Derby were also his work.

**ELMET**. A small principality in ancient Britain, between Leeds and York, "roughly represented by the West Riding of Yorkshire." It retained its independence until early in the seventh century. Edwin (q.v.), King of Deira, on conquering the kingdoms of Bernicia and Elmet, established the Kingdom of Northumbria by the union of Deira, Bernicia, and Elmet. Consult Green, *The Making of England* (London, 1882).

**ELMINA**, ʔl-mē'nā (native name *Dena*). A fortified seaport of the British Colony of the Gold Coast, West Africa, situated 8 miles west of Cape Coast Castle. The castle is the residence of the government officials of the district. It is the chief outlet for the trade of Ashanti. Elmina became the chief exporting point on the Gold Coast during the Dutch occupation, but it has greatly declined since then and suffered much during the Ashanti wars. It came under English control in 1872, when it was claimed by the King of Ashanti, the result being the Ashanti wars of 1873-74. Pop., 1901, 3973.

**ELM INSECTS**. The elm seems peculiarly susceptible to the attacks of foliage-eating insects. Most of these, however, are foreign species, which have been accidentally imported and acclimated and which are likely to attack the



ELM-LEAF BEETLE (*Galeruca xanthomelana*).

a, Adult beetle; b, full-grown larva; c, elm leaf, with grubs eating and laying eggs; d, eggs (magnified).

European elm in preference to American species. Hence it has been recommended that a few European elms be included within all plantations to serve as traps for the insects, which may thus be attacked more easily than if scattered over

the whole plantation. The gypsy moth, brown-tail (see MOTH, BROWN-TAILED), tussock moth (q.v.), and other defoliators, are more or less numerous, especially in New England, where great sums of money (see GYPSY MOTH) have been and continually are spent by local governments in suppression of the evil; while the bagworm and various minor insects, such as bark lice and leaf beetles, attack these trees in the South and West.

The *Elm-Leaf Beetle* is, of all these, perhaps the most generally destructive to the foliage of this tree. It is a well-known European pest, which first appeared in the United States about 1837 and has gradually become widespread. It is a yellowish-brown chrysomelid beetle, a quarter of an inch long, with three indistinct dark stripes on the wings. The beetles begin to feed while the leaves are growing and eat round holes in them. They soon deposit clusters of bottle-shaped orange-colored eggs on the under sides of the leaves and then die. The caterpillar-like grubs speedily hatch and begin feeding. They are black at first, but become more yellowish with each molt, until finally they are wholly yellow except three dark stripes. South of Philadelphia two broods are usually produced annually, but northward only one. The larvæ feed voraciously and soon skeletonize the leaves, and the infested tree rapidly becomes as if burned. The grubs then crawl or fall to the ground and go into the pupa state near or on the surface of the soil, sometimes so numerously as to make a noticeable yellow carpet all about the trunk of the tree. Ordinarily, however, they are more scattered, seeking crevices which will protect them somewhat; and in this state those of the single northern brood or of the second southern brood pass the winter. Full details of this life history will be found in Marlatt's *Elm Leaf Beetle*, published as "Circular No. 8" by the Department of Agriculture (Washington, 1895), and the author recommends the following remedial measures: "The adults, for a week or two after emerging, feed on the newly expanded foliage, and a spraying with Paris green or other arsenical will destroy the great majority of them. Especial pains should be taken to accomplish the destruction of the insect in this stage. . . . If rains interfere with spraying for the adults, or if it be neglected, the trees should be sprayed with arsenical promptly on the first appearance of the larvæ, and the application perhaps renewed a week or 10 days later, especially if rains have intervened."

**ELMIRA.** A village in Waterloo Co., Ontario, Canada, situated on the Canadian Pacific and Grand Trunk railways, 12 miles north of Berlin (Map: Ontario, D 6). The manufacturing industries include foundries and machine shops, boot factories, manufactories of transmission supplies, saw and planing mills, a brickyard, and grain elevators. The village owns its electric-light plant and water works, and is supplied with hydroelectric power. Pop., 1901, 1060; 1911, 1782.

**ELMIRA.** A city and the county seat of Chemung Co., N. Y., 147 miles southeast of Buffalo, on the Lackawanna, the Erie, the Northern Central (Pennsylvania System), and the Lehigh Valley railroads, and on the Chemung River (Map: New York, D 6). It has the New York State Reformatory (see **ELMIRA REFORMATORY**), a State armory, Elmira Free Academy, Elmira College (q.v.), a United States Govern-

ment building ( . . . post office and Federal court . . . Library, Arnot-Ogden Memorial Hospital, Arnot Art Gallery, and homes for orphans and the aged. A monument to the Rev. Thomas K. Beecher is one of the features of the city. Eldridge, Hoffman, Wisner, and Riverside parks and Roricks Glen are worthy of mention. Elmira is noted for the extent and variety of its manufactures, the chief industrial plants being railroad-car shops, iron and steel bridge works, steel-plate works, valve and radiator works, manufactories of boots and shoes, automobile parts, tables, bicycles, glass, fire engines, tobacco and cigars, boilers and engines, doors, sashes and blinds, etc., hardwood-finishing works, silk and knitting mills, tobacco warehouses, dye works, breweries and aluminium works. The city government is administered under the charter of 1906 by a mayor, chosen every two years, and a unicameral city council. Besides the executive and aldermen there are elected by the people the recorder, city judge, and 12 supervisors. Near the site of Elmira, now marked by a monument to General Sullivan, was fought, on Aug. 29, 1779, the battle of Newtown, in which General Sullivan with an American army of 5000 defeated a force of Indians and Tories led by Sir John Johnson and Joseph Brant and numbering about 1500. First permanently settled in 1788, and incorporated as the village of Newtown in 1815, then reincorporated as the village of Elmira in 1828, Elmira became the county seat in 1836 and was chartered as a city in 1864. In 1861 it was chosen as the State military rendezvous and in 1864-65 had one of the northern prisons in which Confederate prisoners were confined. Pop., 1900, 35,672; 1910, 37,176; 1914, (est.), 37,816.

**ELMIRA COLLEGE.** An institution for the higher education of women, founded in Elmira, N. Y., in 1855. It was the first institution exclusively for women which had at the time of its founding as high a standing as colleges for men. It is nonsectarian, but was founded under Presbyterian control. The college confers the degrees of B.A., B.Sc., and M.Sc. upon students of classical and scientific courses, and B.M. upon students of music. There is a graduate department and a summer session. The attendance in 1912-13 was 240, and the faculty numbered 18. The productive funds amount to about \$130,000 and the annual income to about \$90,000. The library contains about 11,000 volumes. The president in 1914 was Rev. A. C. MacKenzie, D.D.

**ELMIRA HEIGHTS.** A village in Chemung Co., N. Y., adjoining Elmira, on the Erie, the Delaware, Lackawanna, and Western, and the Lehigh Valley railroads. It has bridge works, machine shops, knitting mills, and table and pump factories. Pop., 1900, 1763; 1910, 2732.

**ELMIRA REFORMATORY.** An institution situated in Elmira, N. Y. It is the State reformatory for males between the ages of 16 and 30 who have not been previously committed to a State prison. Regarding the term of imprisonment the law states: "Every sentence . . . shall be a general sentence to imprisonment in the New York State Reformatory at Elmira, and the courts of this State . . . imposing such sentence shall not fix or limit the duration thereof. The term of such imprisonment . . . shall be terminated by the managers



of the reformatory, . . . but such imprisonment shall not exceed the maximum term provided by law for the crime for which the prisoner was convicted and sentenced." (Laws of 1877, sec. 2, c. 173.) The institution was opened in 1876, though the law authorizing it was enacted in 1866. Its establishment introduced a new era in prison science. It has had great success and has been widely copied. In comprehensiveness and adaptation of training to individual needs it is unequalled. Down to September, 1910, it had cared for 20,604 prisoners. The average number of prisoners for the year ending Sept. 30, 1910, was 1266, and the average daily maintenance cost per inmate was \$0.535. Consult: Winter, *The Elmira Reformatory* (New York, 1891); Wines, *Punishment and Reformation* (ib., 1895); Brockway, *Fifty Years of Prison Service* (ib., 1912); and the Yearbooks of the Reformatory. See BROCKWAY, Z. R.; PENOLOGY; REFORMATORIES.

**ELMO'S FIRE, SAINT** (from St. Elmo, St. Peter Gonzales, 1190-1246, a Spanish Dominican who is invoked by sailors on the Mediterranean during storms). The popular name of an appearance sometimes seen, especially in southern climates, during thunderstorms, of a brush or star of light at the tops of masts, spires, or other pointed objects. It is sometimes accompanied by a hissing noise and is of the same nature as the light caused by electricity streaming off from points connected with an electrical machine. The phenomenon, as seen at sea, was woven by the Greeks into the myth of Castor and Pollux; and even yet such lights at the masthead are considered by sailors a sign that they are to fear from the storm.

**ELMSHORN**, *ēlms'hörn*. A town in the Prussian Province of Schleswig-Holstein, 24 miles northwest of Hamburg, situated on the navigable Krückau (Map: Prussia, C 2). It manufactures cloth and leather goods, boots and shoes, hats, mineral waters, and soaps. There are also iron foundries, dyeing establishments, and shipbuilding works, and it has a large shipping trade by river. Pop., 1900, 13,640; 1910, 14,789.

**ELMSLEY**, *ēlmz'li*, PETER (1773-1825). An English classical scholar. He was educated at Westminster School and at Christ Church, Oxford, and in 1823 was made principal of St. Alban Hall, Oxford, and Camden professor of ancient history at the university. He visited Italy in search of classical manuscripts and, after devoting the winter of 1818 to researches at the Laurentian Library in Florence, assisted Sir Humphry Davy in deciphering the papyri found in Herculaneum (1819). He is remembered chiefly for his critical edition of the *Heracleida*, the *Medea*, and the *Bacchæ* of Euripides, (q.v.) and of the *Œdipus Tyrannus* and *Œdipus Coloneus* of Sophocles (q.v.). He first recognized that the Laurentian manuscript of Sophocles was supreme among manuscripts of that author. Consult *Elmsleiana Critica* (Cambridge, 1833) and Sandys, *A History of Classical Scholarship*, vol. iii (ib., 1908).

**ELMWOOD PLACE**. A village in Hamilton Co., Ohio, adjoining Cincinnati, on the Cincinnati, Hamilton, and Dayton and the Cleveland, Cincinnati, Chicago, and St. Louis railroads, and on the Miami and Erie Canal. It contains freight yards and extensive steel plants. The village has persistently refused annexation to Cincinnati. Pop., 1900, 2582; 1910, 3423.

**EL OBEID**, *ēl-ô-bād'*, or **IL OBEID**. The capital of Kordofan, a province of the Egyptian Sudan, 2300 feet above sea level, in lat. 12° 20' N. and long. 31° E. (Map: Africa, G 3). It consists of a number of villages inhabited by distinct races. There are a number of mosques and an old Catholic church. Pop. (est.), 8000 (largely of Arabs and Nubians). It has a growing trade in gum, feathers, ostrich products, and ivory. Near El Obeid an Anglo-Egyptian army under Hicks Pasha was annihilated by a Mahdist force, Nov. 3-5, 1883.

**ELOBEY** (*ā'lo-bā'ē*) **ISLANDS**. Two small islands belonging to Spain, situated off the Guinea coast, Africa, in Corisco Bay, at the mouth of the Muni River, in lat. 0° 57' N., long. 9° 30' E. Elobey Grande, the larger, is of much less importance than Elobey Chico, where several factories have been established, the first dating from 1872. Both islands are flat, the smaller being well wooded. There is a Spanish missionary school on Elobey Chico. Pop., 1900, 331; 1910, 354.

**EL'OCUTION** (Lat. *elocutio*, from *eloqui*, to speak out, from *e*, out + *loqui*, to speak). The art of effective speaking, more especially of public speaking. It regards solely the utterance or delivery; while the wider art of oratory, of which elocution is a branch, takes account also of the matter spoken. See **READING**.

**ELOHIM**, *ēl-ô-hēm'* (Heb. gods, pl. of *'eloah*, Ar. *'ilahu*, Aramaic *'elah*, Ass. *ilu*, god). The plural of *Eloah*, used when more than one god is intended, but also in the sense of "deity" in general and as a designation of the one god worshipped by Israel. In the latter . . . attachment of the plural ending serves, as it often does in the Semitic languages, to express the idea of greatness, supremacy, and the like. Elohim is therefore equivalent to "the great *Eloah*," the *Eloah* par excellence. Already in the Tell el-Amarna tablets (beginning of the fourteenth century B.C.), we find, in letters addressed by Palestinian officials to the Egyptian King, *ilani*, the plural of *ilu*, 'god,' used . . . with *ilu*, as *Elohim* with *El* or *Eloah* in some parts of the Old Testament. The use of Elohim in Genesis, more extensive originally than the present Masoretic text would lead us to believe, as a critical study of the early versions reveals, is regarded by some scholars as indicating an original polytheistic setting, while others think that Elohim was preferred to *Yahwe* in the Kingdom of Israel. In view of the numerous Israelitish names compounded with *Yahu* or *Yo*, and the frequent occurrence of *Yaw* or *Yo* on the wine jars found at Samaria (see **AHAB**; **SAMARIA**), the latter view seems less plausible. It may reasonably be supposed that in later times Elohim was preferred from a desire to avoid the stronger anthropomorphic implications connected with *Yahwe*, which is more of a personal name. In this way the substitution of "Elohim" in Ps. liii for "Yahwe" in Ps. xiv may be explained. The same feeling may also have had something to do with the disappearance of *Yahwe* from ordinary use and the various attempts to disguise it. See **JEHOVAH**; **YAHWE**; **PENTATEUCH**.

**ELOHIST AND YAHWIST**. Terms adopted by certain modern biblical scholars to denote the authors of two literary works which they believe to have been used as historical sources in the composition of the Pentateuch as we have it and to have been embodied in it. The terms

are purely conventional names assigned because the one source is supposed to be characterized by the use of *Elohim* (q.v.); the other by the use of *Yahwe* (q.v.). See PENTATEUCH.

**ELOI.** See ELIGIUS.

**ELOISE,** ɛl'ô-êz. A hospital settlement in Wayne Co., Mich., 16 miles from Detroit, on the Michigan Central Railroad. It contains a large hospital, an infirmary, and a sanatorium. The institutions are under the control of the Wayne County Superintendents of the Poor, a board established in 1832. The property is worth about \$900,000. Pop., 1914 (local est.), 1750.

**ELON COLLEGE.** A coeducational institution of higher learning, founded under the auspices of the Christian church, at Elon College, N. C., in 1890. It succeeded the Graham Normal College, founded in 1865. The campus consists of 25 acres, covered for the most part with native oak and hickory. The buildings include the Administration Building, the first college building to be erected, the West Dormitory, the East Dormitory, the power plant, the Alumni Building, the Ladies' Hall, Music, Art, and Expression studios, Domestic Science kitchen, gymnasium, and college dining hall. The students in the college in 1914 numbered 386, of whom 332 were undergraduates. The instructors numbered 22. The endowment amounted to \$150,000, and the income from all sources to about \$75,000. The plant of the college was valued at \$300,000. The library contains about 12,000 volumes. The president in 1914 was William Allen Harper, M.A., Litt.D., LL.D.

**ELONGATION** (ML. *elongatio*, from Lat. *elongare*, to lengthen, from *e*, out + *longus*, long; connected with Goth. *lagg*, Icel. *langr*, OHG., Ger. *lang*, AS. *lang*, long, Eng. *long*), **ANGLE OF.** The difference between the geocentric longitudes (q.v.) of a planet and the sun. The close circumpolar stars (such as Polaris) are sometimes said to be in elongation when their azimuth (q.v.) measured from the north point of the horizon has its greatest possible value.

**ELOPEMENT** (from *elope*, from Dutch *ontloopen*, to run away, from *ont*, away + *loopen*. Eng. *lope*, to run). In law, the act of a married woman who abandons her husband and cohabits with another man. In the early period of English law, before the right of divorce was recognized, it was provided by the Statute of Westminster II (13 Edw. I, c. 34) that an eloping wife, if condemned by the church and unforgiven by her husband, should lose her dower in her husband's lands. To-day the consequences of the act is to free the husband from his common-law liability for her support and in all countries where divorce is recognized to entitle the husband to a dissolution of the marriage relation. Where the elopement is notorious, the husband is not bound to pay debts of her contracting, and whoever, with notice of the separation, gives her credit does so at his own risk. See ADULTERY; DIVORCE; HUSBAND AND WIFE.

**EL-ORDEH,** ɛl-ôr-dā', Arabic for "the rest house," also known as NEW DONGOLA. The capital of the Province of Dongola, in the Egyptian Sudan, situated on the left bank of the Nile. It is a prosperous town, with a number of public buildings and fine bazars. It has a population of about 20,000. Seventy-five miles above El-Ordeh, on the right bank of the Nile, lies Old Dongola, or Dongola Aguza, once a flourishing

place, now reduced to an insignificant sand-swept village.

**EL'OTHERIUM** (Neo-Lat., from Gk. *ἑλος*, *helos*, marsh + *θηρίον*, *thērion*, wild beast). A large fossil pig of the Miocene rocks of Europe and North America, and differing from the other Miocene members of the family in the reduction of the number of toes on both hind and fore feet to two. See SWINE.

**ELOY'SIUS, SAINT.** See ELIGIUS.

**EL PASO,** ɛl pā'sô. A city, port of entry, and the county seat of El Paso Co., Tex., directly opposite Juarez, Mexico, on the Rio Grande (Map: Texas, A 6). It is of great commercial importance as a gateway of the trade between Mexico and the United States and also as a railroad centre, being the terminus of the National of Mexico, the El Paso and Southwestern, the Texas and Pacific, the Southern Pacific, the Galveston, Harrisburg, and San Antonio, and the Rio Grande and El Paso railroads. El Paso is situated at an altitude of 3762 feet and is popular as a health resort. Noteworthy features include the State School of Mines, Fort Bliss (a regimental cavalry post), Carnegie library, Knights of Columbus Home, 13 public parks, Federal building, Masonic temple, courthouse, city hall, several fine hotels, and Clouderoft, which is in the vicinity. The city carries on an extensive trade in copper, silver, and lead, machinery, live stock, wool, and hides, and has important wholesale and jobbing interests. Its port handled in 1912 merchandise valued at \$10,852,000, of which \$6,172,000 represented exports. El Paso is also the centre of a rich fruit and vegetable growing region, the great Elephant Butte Dam, erected at a cost of nearly \$10,000,000, furnishing ample water for irrigation. The industrial establishments include a large custom smelter, a wood-finishing and box factory, foundries and machine shops, cement plant, large railroad repair shops, brick and tile works, sash and door, macaroni, and cigar factories, brass works, and flour mills. El Paso was incorporated as a city in 1873 and adopted the commission form of government in 1907. Its receipts in 1912 were \$1,986,000, while its payments amounted to \$1,882,000; the chief items of expenditure being: education, \$164,000; police department, \$54,000; and fire department, \$65,000. The water-works system, costing \$1,500,000, is owned by the city. El Paso is supposed to have been visited early by Spanish explorers. During the Civil War it was occupied alternately by Federal and Confederate troops and for a time was the base for operations against New Mexico and Arizona. Long an unimportant village, with a population in 1880 of only 736, it developed rapidly. Pop., 1890, 10,338; 1900, 15,906; 1910 (including suburbs), 39,279; 1914 (U. S. est.), 49,505.

**EL PASO DEL NORTE,** ɛl-pā'sô del nôr'tá. See CIUDAD JUAREZ.

**ELPHINSTONE, GEORGE KEITH.** See KEITH, GEORGE KEITH-ELPHINSTONE.

**ELPHINSTONE, MOUNTSTUART** (1779-1859). An Anglo-Indian statesman and historian, one of the founders of the Indian Empire, the fourth son of John, eleventh Baron Elphinstone. Part of his boyhood was spent in Edinburgh Castle, of which stronghold his father was governor. He was educated at the Edinburgh High School and afterward at Kensington. In his seventeenth year he proceeded to Calcutta in the employ of the East India Company and two years

later, in 1798, escaped the massacre of Europeans at Benares only by the fleetness of his horse. He became assistant to the British Resident at Poonah in 1801 and later, although a civilian, acted as aid-de-camp to Sir Arthur Wellesley and took an active part in the battles of Assaye, Argaum, and G. After the Mahratta War he was appointed Resident at Nagpur. In 1808 he was sent as envoy to Kabul and in 1811 was made Resident at Poonah. On the renewal of hostilities with the Mahrattas in 1817 he assumed command of the English troops during the battle of Kirki and contributed largely to their success. He subsequently governed the conquered districts with remarkable force and consideration, preserving the native customs and rights, so as to win the regard of his subjects and strengthen British rule. In 1819-27 he was Lieutenant Governor of Bombay and drew up the Elphinstone Code of laws which laid the foundation of state education in India. He spent two years in travel, visiting Egypt, Palestine, Greece, Turkey, Italy, and France, and returned to England in 1829, after 33 years' absence. He was twice offered the governor-generalship of India, but declined, and his last 30 years were devoted to study and authorship. He wrote *An Account of the Kingdom of Cabul and its Dependencies in Tartary, Persia, and India* (1815) and a *History of India* (1841). Both are standard authorities. He died Nov. 20, 1859. A statue in his honor was erected in St. Paul's Cathedral. Consult Colebrooke, *Life of Mountstuart Elphinstone* (London, 1884), and Cotton, *Mountstuart Elphinstone and the Making of South-Western India* (Oxford, 1896).

**ELPHINSTONE, WILLIAM** (c.1431-1514). A Scottish prelate and statesman, founder of Aberdeen University. The natural son of William Elphinstone, rector of Kirkmichael, and Archdeacon of Teviotdale, he was born at Glasgow and educated there at the grammar school and University. In his twenty-ninth year he became a student of civil and canon law at the University of Paris, where in three years he obtained a doctorate of decrees, was appointed professor, and also became lecturer at Orleans University. He returned to Scotland after an absence of nine years and became successively official general of the diocese of Glasgow (1471-72), rector of the university (1474), and Archdeacon of Lismore, judicial official of Lothian, and Privy Councilor (1478). He effectively accomplished several important and delicate missions to France, England, Burgundy, and Austria, and his services were rewarded with the bishopric of Ross in 1481 and that of Aberdeen in 1483. In the last year of the reign of James III he was Chancellor of the kingdom. Under James IV he discharged important diplomatic missions to England and the Continent, and was Keeper of the Privy Seal from 1492 until his death. The establishment of printing in Scotland was due to his influence and support. In 1494 he procured the papal bull for the foundation of Aberdeen University, which was dedicated to St. Mary in 1500, and its name afterward changed to King's College. His principal work is *Breviarium Aberdonense* (1508-10; reprint, 2 vols., London, 1850).

**EL RENO.** A city and the county seat of Canadian Co., Okla., 27 miles west of Oklahoma City, on the Rock Island, and the St. Louis. El Reno and Western railroads, and on the North

Fork of the Canadian River (Map: Oklahoma, D 3). It has a Carnegie library, a sanitarium, Indian schools, Sacred Heart Academy, and a United States land office. Its industries include cotton gins, machine shops, brick plant, flour and alfalfa mills, and manufacturing of brooms, cement stone, and washing machines. There are also repair shops and division offices of the Rock Island system. El Reno has adopted the commission form of government and owns its water works. Pop., 1900, 3383; 1910, 7872.

**EL ROSARIO**, ɛl rô-sá-ré-ô. See ROSARIO.

**ELSASS** and **ELSASS-LOTHRINGEN**, ɛl'ss 15'ring-en. See ALSACE-LORRAINE.

**ELS'BERG**, ɛl'bërk, LOUIS (1836-85). An American physician, born at Gerlohn, Prussia. He emigrated to America with his parents in 1849 and settled in Philadelphia, where he attended the public schools. Later he attended Jefferson Medical College. He published numerous papers on throat diseases, introduced laryngo-copy into the United States, and wrote *The Throat and the Production of the Voice* (1880) and *Harmony, Sound, and Music*. He first illustrated the character of undertones and the division of sound and invented many instruments which are used in operations on the throat and ear. From 1880 to 1884 he published the *Archives of Laryngology*.

**ELSHEIMER**, ɛls'hî-mër, ADAM (1578-1620). A German landscape and historical painter and etcher. He was born in Frankfort-on-the-Main and studied there under Uffenbach and probably in Venice under Rottenhammer. In 1600 he went to Rome, where he obtained the patronage of Pope Paul V, and resided until his death. He is chiefly remarkable for the influence he exercised over all schools of painting, especially the Dutch. He introduced a more realistic and natural spirit into the biblical and mythological genre and perfected landscape painting on a small scale. His pictures are simple and unpretentious in conception and motive as well as size. He shows great feeling for idyllic beauty and for form and excels in depicting the nude. His color is rich in richness and depth, and his treatment of light, both natural and artificial, is masterly. It does not affect as pronounced chiaroscuro as Rembrandt, but in his solution of atmospheric problems rather resembles Rubens. He is well represented in the Dresden Gallery by "The Flight into Egypt," "Philemon and Baucis," and other pictures; in the Munich Pinakothek, by "St. John the Baptist Preaching" and others; in the Louvre, by the "Good Samaritan"; in Madrid, by the "Mocking of Ceres"; and there are also pictures by him in the galleries of Berlin, Vienna, Frankfort, Florence, Rome, and other cities. Consult Bode, *Studien zur Geschichte der holländischen Malerei* (Brunswick, 1883).

**ELSIE VENNER, A ROMANCE OF DESTINY.** A novel by Oliver Wendell Holmes, published in 2 vols. in 1861.

**ELSINORE**, ɛl'sî-nôr', Dan. **HELSINGÖR**, hêl'sîng-ër. A seaport of Denmark, on the island of Zealand, situated on the west shore of the sound, at its narrowest part, opposite the Swedish town of Helsingborg, and 24 miles north of Copenhagen (Map: Denmark, F 2). The town has a charming site, with several interesting buildings, notably the town hall and the hospital. To the north is the castle of Kronborg, built by Frederick II of Denmark in

1577-85, to insure the collection of tolls from vessels passing through the strait, the toll being exacted till 1857. This imposing castle, now used as barracks, is associated with Shakespeare's *Hamlet*. The platform before the castle, where the ghost appears in the play, is shown the visitor, as is also Hamlet's so-called tomb—a column on a hill not far away. Marienlyst, formerly a summer residence of the royal family, now a bathing place, lies three-quarters of a mile to the northwest. Elsinore's industries consist chiefly of cloth weaving, net making, shipbuilding, founding, and general marine engineering. The harbor is excellent, admitting ships of 20-feet draught, and is frequented by numerous vessels, especially for repairs. Coal is the principal article of import. Pop., 1901, 13,902; 1911, 13,783.

**ELSON, HENRY WILLIAM** (1857- ). An American historian, born in [unclear] Co., Ohio. He graduated from Thiel College (Pa.) in 1886, from the Lutheran Theological Seminary (Philadelphia) in 1889, and studied also at the University of Pennsylvania. After serving as pastor at [unclear] (1889-93), and of St. Stephen's, [unclear] (1893-95), he left the ministry to lecture for the University Extension Society of Philadelphia. In 1905 he became professor of history and economics at Ohio University. He is author of several excellent text and reference books: *Side Lights on American History* (2 vols., 1899-1900); *How to Teach History* (1901); *Star-Gazers' Hand-Book* (1902; 2d ed., 1909); *History of the United States of America* (1904; 2d ed., 1908); *Elson's History* (5 vols., 1905); *School History of the United States* (1906); *A Child's Guide to American History* (1909); *Comets* (1910); *Guide to English History* (1911); *Guide to German History* (1912).

**ELSON, LOUIS CHARLES** (1848- ). An American writer on music, born in Boston, Mass. After studying music in Boston and Leipzig, he returned to Boston, where he became editor of the *Vox Humana*. Afterward he wrote for the *Musical Herald* and the *Boston Courier* and became musical editor of the *Boston Advertiser*. After 1881 he was lecturer at the New England Conservatory of Music. He translated and arranged many songs. His first literary success was *Curiosities of Music* (1883). Among his other books are: *German Songs and Song Writers* (1884); *The Great Composers* (1897); *Our National Music* (1899), a standard work; *Shakespeare in Music* (1900); *History of American Music* (1904); *Folksongs of Many Nations* (1905); *Musical Dictionary* (1906); *Mistakes and Disputed Points in Music* (1910). He wrote the articles on music for the *New Standard Encyclopædia* and for the *Americana*, and was editor in chief of *Modern Music and Musicians* (1912).

**ELSSLER, FANNY** (1810-84). An Austrian dancer, born in Vienna. Along with her elder sister, Therese, she was trained for the ballet in Vienna and Naples. The first triumph of the sisters took place in Berlin, where they appeared in 1830. In her subsequent travels, by her beauty, amiability, and mastery of her art, Fanny charmed all classes of society. In 1841 the two sisters went to America, where they excited unwonted enthusiasm. After Fanny had earned laurels in St. Petersburg she returned, in 1851, to Vienna, to take a final leave of the stage. She then retired to Hamburg, where she

remained till, in 1854, she settled finally in Vienna.—**THERESE** (1808-78) was less graceful than her sister, but also exhibited great strength, boldness, and agility. In 1850 she became the wife of Prince Adalbert of Prussia (who died in 1873) and was made Baroness von Barnim by the King of Prussia.

**ELSTER.** The name of two rivers of Germany, more exactly known as the White and the Black Elster (Map: Germany, E 3). The former, rising at the foot of the Elster Mountains, on the northwest boundary of Bohemia, flows north as far as Leipzig, where it turns westward and empties into the Saale (q.v.), 3 miles south of Halle, in Prussian Saxony, after a course of nearly 120 miles. Its chief affluent, the Pleisse, joins it near Leipzig. It has been made navigable for small vessels as far as Leipzig, not far from which point the river divides, the left branch, known as the Luppe, also flowing into the Saale. The Black Elster rises in the Kingdom of Saxony, within 2 miles of Elstra, flows north into Prussia, then bends northwest and joins the Elbe 8 miles southeast of Wittenberg. Its total length is about 135 miles, of which only about 40 miles have been made navigable.

**ELSTRACKE, REGINALD, or RENOLD** (c.1590-1630). An English line engraver. He is usually considered to have been born in London, but more probably came originally from Flanders. He studied under Crispin van de Passe in Cologne and came to London with the younger members of his master's family in the early part of the seventeenth century. He worked chiefly for booksellers and executed his plates entirely with the graver. The prints of his portraits are very scarce. His works express a good deal of character in a firm and forcible manner, but are of more interest historically than as works of art. His chief work was a volume of 32 plates, *Basiliologia; a Book of Kings, being the true and lively effigies of all our English Kings from the Conquest untill this present* (1618). Among his most prized engravings is the double whole-length portrait of Mary Stuart, Queen of Scots, and Lord Darnley, a print of which was purchased in 1884 by the British Museum for £150. Other rare portraits are Princess Elizabeth, James I. Anne of Denmark, and Sir Richard Whittington, with his hand resting on a skull.

**ELTON** (Tatar *Altan-Nor*, Gold Lake). A salt lake in the Russian Government of Astrakhan, situated about 70 miles east of the Volga (Map: Russia, G 5). The lake with an area of 62 square miles is the remnant of a much larger body of water which has become partly desiccated, and now its surface is about 50 feet below sea level. It is very shallow, and its bottom is covered with salt. It receives eight salt-water streams, but has no visible outlet. Salt began to be extracted from the lake as early as 1655. In 1747 the government began to work the salt deposits of Elton, and the output up to 1862 amounted to over 8,000,000 tons. With the opening of the Crimean salt fields and the construction of the railway to the salt lake Bakuntchak, the working of the Elton salt deposits was given up (1862).

**ELTON, CHARLES ISAAC** (1839-1900). An English lawyer, born at Southampton and educated at Balliol College and at Trinity College, Oxford. He was elected justice of the peace for Somerset and was member of Parliament for

West Somerset from 1884 to 1885 and from 1885 to 1892. His principal works include: *Commons and Waste Lands* (1868); *Copyholds and Customary Tenures* (2d ed., 1893); *Custom and Tenant Right* (1882); *Origins of English History* (1890); *W. Shakespeare: His Family and Friends* (1904).

**ELTON, JAMES FREDERIC** (1840-77). An English explorer. He entered the Bengal army at the time of the Indian mutiny and saw much service in that colony as well as in China, becoming captain. Subsequently he was attached to the staff of the French army in Mexico, in 1866, and published an account of his adventures there, entitled *With the French in Mexico* (1867). In 1868 he went to Natal and began a series of explorations through Africa, the results of which were reported by him in his journal illustrated by himself with exceptionally fine maps and sketches. These journals were edited by H. B. Cotterill, under the title *Travels and Researches among the Lakes and Mountains of Eastern and Central Africa* (1879). He entered the government service in 1873 and was appointed British Consul in Portuguese Territory, with residence at Mozambique, in 1875. While returning from a successful mission to the chiefs of several African tribes, he was stricken with fever, from which he died in Ugogo, on Dec. 13, 1877, near the town of Usekhe. He wrote a book entitled *Notes and Sketches in East Africa and on the Suppression of the Slave-Trade, 1873-1877*, which was not published for some years.

**ELTON, OLIVER** (1861- ). An English literary historian, educated at . . . School and at Corpus Christi, Oxford. . . . lecturer on English literature at Owens College, Manchester, in 1890-1900, and then became professor at the University of Liverpool. With F. Y. Powell he published for the Folklore Society a version of the first nine books of Saxo Grammaticus's *Historia Danica* (1894), and he edited the *Life of Frederick York Powell* (1906). Besides contributions to reviews and to the *Encyclopædia Britannica*, he wrote: *The Augustan Ages* (1899); the standard study of Michael Drayton (1906); *Modern Studies* (1907); *Survey of English Literature from 1780 to 1830* (1912).

**ELTZBACHER, ELTSBÄG-ÄR, PAUL** (1868- ). A German jurist. Educated at Heidelberg, Leipzig, Strasbourg, and Göttingen, he became a judge and a privatdocent at Halle and in 1906 professor of law at the Berlin Handelshochschule. He wrote: *Ueber Rechtsbegriffe* (1900); *Die Handlungsfähigkeit* (1903); *Die Unterlassungsklage* (1906); *Grossberliner Mietsverträge* (1913), etc.; but is best known by his *Lehrbuch des Rechts* (1900; Eng. trans. by Byington, 1908), which has been translated into nearly every modern language and is the most complete and unbiased treatment of the subject. In 1910 he wrote on anarchism for the *Handbuch der Politik*.

**ELUTRIATION** (from Lat. *elutriare*, to wash out, from *eluvare*, to wash out, from *e*, out + *luere*, to wash). The process of separating fine and coarse pulverized materials by putting them in suspension in water and taking advantage of the different rates of sedimentation for the various materials. Thus, coarse, heavy substances will sink to the bottom of a vessel quickly, leaving finer material behind. The process may be repeated by successive decant-

ings or siphonings of the liquid. The process is used for preparing high-grade clays for porcelain manufacture. In this treatment the clay is first disintegrated in water, after which the mixture passes through a long series of connected troughs of very low pitch, in which the sandy particles settle out. The clay suspended in water is then led to settling tanks, where the clay slowly sinks to the bottom and is drawn off into filter presses. (Consult Ries, *Clays, Occurrence, Properties, and Uses* (New York, 1908, and Watts, *Bureau of Mines, Bull.* 53, 1913.) Elutriation on a grand scale is exhibited by nature in the deposit of fine earths. The immense beds of sedimentary clay, covering many square miles in area, are the result of the slow subsidence of fine particles suspended in water passing in a slow but steady current in estuaries and discharging into lakes or ocean where the sediment settles.

**ELVAS, ALVÁSH.** A fortified city of Portugal, situated in a very fruitful district in the eastern part of the Province of Alemtejo, 10 miles west of the Spanish town of Badajoz (Map: Portugal, B 3). It is the strongest fortress in Portugal, having two formidable forts, Fort Santa Lucia and Fort Rippe (also known as Nossa Senhora da Graça)—the former to the south and the latter, almost entirely shell proof, to the north, of the city. Elvas has a cathedral, built at the close of the fifteenth century, which contains some fine paintings; there are also a theatre, a hospital, and a fine aqueduct, begun in the fifteenth century and completed in 1622. This aqueduct consists of four tiers of arches, built upon one another, rising to the height of about 120 feet. In the surrounding districts olives and grapes are cultivated, and some iron is mined. Elvas has been the seat of a bishop since 1570. The chief manufactures are arms and jewelry. Pop., 1890, 13,291; 1900, 14,018. Elvas is the Roman Alpesa and the Moorish Balash. It was fortified by the Moors and later became an object of contention between the Moors, Portuguese, and Spaniards, until the Portuguese finally won it in 1226. During the Peninsular War it was a place of great strategic importance and in 1808 was captured by the French under Marshal Junot. It was soon afterward given up, in accordance with the terms of the Convention of Cintra.

**ELVENICH, EL'VE-NIK, PETER JOSEPH** (1796-1886). A German theologian and philosopher. He was born at Embken, District of Aix-la-Chapelle, and was educated at Münster and Bonn. He was appointed professor at Bonn in 1826 and three years later was called to the chair of philosophy at Breslau, where in 1840 he also became royal librarian. He was one of the foremost defenders of Hermesianism, and after the publication of the papal decree of Jan. 7, 1836, denouncing the writings of Hermes, he visited Rome in order to secure a revocation of the edict. His principal works include: *Acta Hermesiana* (2d ed., 1837); *Aktenstücke zur geheimen Geschichte des Hermesianismus* (1845); *Die Wesenheit des menschlichen Geistes* (1857).

**ELVER.** See EEL.

**ELWART, EL'VÄR', ANTOINE AIMABLE ELIE** (1808-77). A French musician. He was born in Paris, where he first appeared in early boyhood as a chorister at Saint-Eustache. After completing his studies under Reicha, Fétis, and Le Sueur, at the Conservatory, where in 1828

he had founded the since celebrated *concerts d'émulation*, he went to Italy in 1834 as the recipient of the Prix de Rome. Upon his return in 1836 he was appointed professor at the Conservatory and retained this position for more than 30 years. His writings on music include: *Dupré, sa vie artistique* (1838); *Le chanteur accompagnateur* (1844); *Histoire de la société des concerts du conservatoire* (2d ed., 1863; continued up to 1885 by Deldevez); *Histoire des concerts populaires* (1864).

**ELWELL, FRANK EDWIN** (1858– ). An American sculptor. He was born at Concord, Mass., where he received his first instruction under May Alcott and Daniel Chester French. His real training was derived at the Ecole des Beaux-Arts and the Academy of Ghent and under Falguière in Paris. In 1885 he returned to America and opened a studio in New York. Elwell possesses striking originality of conception and fertility of invention. His execution is variable, and occasionally deficient in line, but his work is always essentially sculptural. It includes such creations as "Death and Strength" (Edam, Holland); "Diana and the Lion" (Art Institute, Chicago); "Egypt Awakening" (Paris Salon, 1896); an equestrian statue of General Hancock at Gettysburg; "New Life" (1899, Lowell Cemetery, Mass.); "Kronos" (Harvard University); a monument to Edwin Booth at the statue of "Dickens and Little Nell" in Park, Philadelphia; a monument to General di Cesnola in Kensico Cemetery, N. Y. (1903); marble statues representing Greece and Rome for the New York City customhouse; busts of Vice Presidents Morton and Hobart (Senate Chamber, Washington); statues of Rear Admiral Davis (1910, Naval Monument, Vicksburg) and General Steele (Military Park, Vicksburg, 1911). His "Water Boy of Pompeii" is in the Metropolitan Museum (New York City), where he was curator of statuary from 1902 to 1905. He received a highest award at the World's Fair, Chicago, 1893, and became in 1910 director of the New York School of Applied Design for Women.

**ELWOOD.** A city in Madison Co., Ind., about 40 miles (direct) north-northeast of Indianapolis, on the Lake Erie and Western and the Pittsburgh, Cincinnati, Chicago, and St. Louis railroads (Map: Indiana, F 4). It is in the natural gas belt, carries on a trade in live stock, grain, and produce, and has large tinplate mills, ironworks, saw and planing mills, brickyards, canning factories, and manufactures of plate glass, lamp chimneys, shovels, etc. The city maintains a public library. Pop., 1900, 12,950; 1910, 11,028.

**ELY, ELY.** A city of Cambridgeshire, England, situated on rising ground near the Ouse, on the Isle of Ely, in the fen country, 16 miles north-northeast of Cambridge (Map: England, G 4). The city consists of a single long street, retaining several mediæval dwelling houses. It derives its celebrity from its ecclesiastical architecture: the ancient churches of St. Mary and of the Holy Trinity, the Episcopal Palace of the fifteenth and sixteenth centuries, remains of conventual establishments, and, above all, the cathedral, one of the largest in England, begun in 1083, completed in 1534, and restored since 1847. It presents an interesting mixture of Saxon, Norman, and early English architectural types. The interior dimensions are:

length, 530 feet; breadth, 77 feet; height, 62 feet; length of transepts, 180 feet. Its principal features are the decorated octagon and lantern tower, 170 feet high, built between 1322 and 1342, and the only Gothic dome extant; the late Norman nave; the English Galilee, or Western, porch; the decorated lady chapel; and the choir, with its fine carvings and sculptures. Extensive market gardening is carried on in the neighborhood of Ely for the metropolitan and Cambridge markets, and the manufacture of pottery and pipes engages the attention of a few of the inhabitants. Etheldreda, daughter of Anna, King of East Anglia, founded a monastery here about 673 A.D. In 870 the Danes ravaged the Isle of Ely and destroyed the monastery, which was rebuilt in 970 by St. Ethelwold, Bishop of Winchester. This remained till 1083, when the new church was begun, which was converted into the cathedral and the abbey erected into a see in 1109. Ely was one of the last strongholds of the Saxons after the Conquest, and was the "camp of refuge" of Hereward in 1071. Among the celebrities connected with Ely are Abbot Thurston, who, with Hereward, defended the Isle against William the Conqueror; Longchamps, Chancellor and Regent under Richard I; and Bishop Andrews. Pop., 1901, 7700; 1911, 7917. Consult: Stewart, *Architectural History of Ely Cathedral* (London, 1868); Murray, *Eastern Cathedrals* (ib., 1881); Sweeting, *The Cathedral Church of Ely* (ib., 1901); Curtis, "Ely Cathedral," in *The Architectural Review*, vol. ii, N. S. (Boston, 1913).

**ELY.** A city and summer resort in St. Louis Co., Minn., 117 miles north by east of Duluth, on the Duluth and Iron Range Railroad (Map: Minnesota, F 3). It is situated in the centre of the Vermilion Iron range, near a number of lakes and waterfalls; has a fine high-school building and city hall and carries on a trade in iron, lumber, fish, and furs. Under a revised charter of 1903 its government is vested in a mayor, elected annually, and a board of aldermen. The city owns its water works and electric-light plant. Pop., 1900, 3717; 1910, 3572.

**ELY, ISLE OF.** A marshy plain comprising the southern part of the Bedford Level and the part of Cambridgeshire, England, north of the Ouse (Map: England, G 4).

**ELY, RICHARD THEODORE** (1854– ). An American economist, born at Ripley, N. Y. He graduated at Columbia College in 1876, received the degree of Ph.D. at Heidelberg in 1879, and was head of the department of political economy at Johns Hopkins University from 1881 to 1892, when he became professor of political economy in the University of Wisconsin. He was secretary of the American Economic Association from its inception in 1885 to 1892 and president from 1899 to 1902. In 1894 an unsuccessful attempt was made to depose him from his chair at Wisconsin for teaching Socialistic doctrines. He was one of the first of the professional economists to break with the notion that government interference in economic affairs is always an evil, and in his writings he frequently advocates state interference as a means of regulation. His publications include: *French and German Socialism* (1883); *Labor Movement in America* (1886); *Taxation in American States and Cities* (1888); *Political Economy* (1889); *Outlines of Economics*



(1893); *Socialism: An Examination of its Nature, its Strength, and its Weakness, with Suggestions for Social Reform* (1894); *The Social Law of Service; Monopolies and Trusts* (1900; new ed., 1912); *The Coming City* (1902); *Studies in the Evolution of Industrial Society* (1903; new ed., 1913). In collaboration with Prof. G. R. Wicker he wrote *Elementary Principles of Economics* (1907); and in collaboration with T. S. Adams, M. O. Lorenz, and A. A. Young, *Outlines of Economics* (1908; several subsequent editions). In 1914 he published *Property and Contract in their Relation to the Distribution of Wealth*. He also edited *Macmillan's Citizen's Library of Economics, Politics, and Sociology*. Throughout his teaching career he was a frequent contributor to periodical literature, both scientific and popular.

**ELY, THEODORE NEWEL** (1846– ). An American civil engineer. He was born at Watertown, N. Y., and graduated from Rensselaer Polytechnic Institute in 1866. He also received the honorary degrees of M.A. from Yale University in 1897 and Sc.D. from Hamilton College in 1904. From 1868 to 1910 he was connected with the engineering department of the Pennsylvania Railroad, for the last 17 years of this period being chief of the motive-power department of lines west of Erie and Pittsburgh. He held directorships in the Pennsylvania Steel Company and the Cambria Steel Company, was trustee of the Drexel Institute and the Philadelphia Commercial Museum, and director of the Pennsylvania Academy of Fine Arts. In 1904 he became president of the Eastern Railroad Association, and he was chosen an honorary member of the American Institute of Architects and vice president of the American Academy in Rome.

**ELYMAS** (Lat., from Gk. Ἐλύμας). A Jewish sorcerer and prophet, who, according to Acts xiii. 6-12, opposed Paul before the Proconsul Sergius Paulus at Paphos in Cyprus and was smitten with temporary blindness. There are two difficulties connected with his personality—one concerning his name, the other his historical character. In verse 6 he is called Bar Jesus, in verse 8 Elymas, which is there explained as meaning "Magian," or sorcerer. Some scholars think Bar Jesus was the original name and explain Elymas by an Arabic root as "The Wise Man." Others prefer Elymas, and regard Bar Jesus as a Christian name designating him after the passing of his blindness and his consequent conversion as a "follower of Jesus." In the latter case Elymas should probably be understood as a contraction of Elymaios, "the Elamite," which might have been interpreted vaguely as "A wise man from the East," or "Magian," and originally have been a proper name, Elam. (See **ELAM**.) The close similarity of this story to that of Simon Magus in Acts viii has led many to see in it a defense of Paul against the identification of this Apostle with the Magian so common among Judaizing Christians. Yet it seems possible that, as in the case of Simon, so in this instance, an actual historic personage has been seized upon, first by the opponents of Paul as the basis of a caricature, and then by his friends to set forth his equality with those accounted preëminent both in confutation of error and in miraculous deed. The historical Elam-Elymas may, like Simon of Gitta, have been a Gnostic thinker and a student of occult science.

Consult Krenkel, *Josephus und Lukas* (Leipzig, 1894).

**ELYOT, or ELIOT, SIR THOMAS** (c.1490-1546). An English diplomat and author, born probably in Wiltshire. He was twice Ambassador to Charles V (1531 and 1536) and was a member of Parliament in 1542. In 1531 he published a volume on the ethics of government, *The Boke named the Governour*, of which there is an excellent edition by H. H. S. Croft (1880); it is based on a work by Francesco Patrizzi. Elyot was a friend of Thomas More and Thomas Cromwell. He translated from the Greek and the Italian, wrote a popular work on medicine, *The Castell of Helth* (1534), and compiled the first elaborate Latin-English dictionary, entitled *The Dictionary of Syr T. Eliot, knyght* (London, 1538 and 1545), which was the basis of Cooper's *Thesaurus*. Consult Croft's preface to his edition of the *Governour*.

**ELYRIA, è-lîr'î-à**. A city and the county seat of Lorain Co., Ohio, on the Black River, 25 miles west of Cleveland, 7 miles south of Lake Erie, and on the Lake Shore and Michigan Southern, and the Baltimore and Ohio railroads (Map: Ohio, F 3). It has a public library, a hospital, and a fine natural park. The city has extensive manufactures, including automobiles, telephones, home-lighting plants, flour, feed, canned goods, concrete blocks and moldings, paints, metal polish, switchboards, screws, machine parts, iron, steel, iron, strip steel, etc. Elyria is the source of Berea sandstone. The water works are owned by the city. Pop., 1900, 8791; 1910, 14,825; 1914 (U. S. est.), 17,396.

**ELYSÉE, è-lé'zà', PALAIS DE L'**. The official residence of the President of the French Republic, on the Rue du Faubourg Saint-Honoré and the Champs Elysées, Paris, built by Molet in 1718. It was originally the mansion of the Comte d'Evreux, but, under Louis XV, the residence of Madame de Pompadour. It was occupied by Louis Napoleon while President in 1848-52 and has served its present purpose since 1871.

**ELYSIAN (è-lîzh'î-an) FIELDS** (Lat. *Elysii Campi*). A term used in general for Elysium (q.v.) and particularly applied to a region near Baiæ, Italy, supposed, from its beauty and fertility, to resemble the Abodes of the Blessed. See **ISLANDS OF THE BLESSED**.

**ELYSII CAMPI**. See **ELYSIAN FIELDS**.

**ELYSIUM, è-lîzh'î-ûm** (Lat., from Gk. Ἐλύσιον (Πεδίον), *Elysion* (*Pedion*), Elysian, Plain). In classical mythology, the place where the souls of the good dwell after death. Two conceptions are clearly marked. The earlier is indicated in the *Odyssey* (iv, 563 ff.) and continues till late times. Here Elysium is a place at the end of the world, by the ocean, to which specially favored mortals are transported by the gods, usually without separation of the soul from the body, to enjoy perpetual blessedness. Elysium is thus identified with the Islands of the Blessed (q.v.), or is said to be situated on these islands. The other view, less ancient and perhaps less common, is prominent in Vergil (*Æneid*, vi, 541 ff.), where Elysium is that part of the Lower World in which dwell the souls or shades of the good (cf. **TARTARUS**). This view differs from the first conception, not merely in the location of Elysium, but in making it a

place to which access is determined by the deeds done in this life and not by the favor of the gods. In Homer Elysium is promised to Menelaus solely because he is the husband of Helen and son-in-law of Zeus. Elysium is not to be confused with the asphodel meadow in Homer, where the shades of the dead lead a mournful, restless life in the gloomy realm of Hades. Consult Rohde, *Psyche* (2d ed., Heidelberg, 1896).

**ELZE**, ɛl'tse, KARL (1821-89). A German literary historian. He was born in Dessau and was educated at Leipzig and Berlin. After frequent travels in England and Scotland, where he was engaged in extensive literary researches, he was in 1875 appointed to the newly established chair of English language and literature at the University of Halle. Like Michael Bernays and other contemporaneous investigators, he sought to apply the methods of classical philology to the modern science and devoted himself chiefly to the classics of English literature. One of his best and most popular works was the *Englischer Liederschatz*, which passed through five editions (5th ed., 1869). Other important works include: the biographical and critical study entitled *William Shakespeare* (1876; trans. by Schmitz, 1888); the biography of Lord Byron (1870); the biography of Sir Walter Scott (1864); *Grundriss der englischen Philologie* (1877).

**ELZEVIUS**. A family of Dutch printers, famous for their editions of the classics and of French historical and political authors, among their best-known series being *Les petites républiques*.—**LOUIS** (1540-1617), who founded the family's reputation, began printing in 1583, and on his own account in 1592 in Leyden with Merula's *Eutropius*.—Of his seven sons five followed his profession: **MATTHIEU** in 1617-1622, **LOUIS** in 1590-1621, **GILLES** in 1599, **JOOST** about 1617, and **BONAVENTURE** in 1617-1652. The last, in partnership with various nephews, was the most celebrated.—A grandnephew, **JEAN**, continued the business in Leyden.—**DANIEL**, a son of Bonaventure, with **LOUIS**, the third of his name, established a house in Amsterdam (1655), where the latter had been printing since 1638.—Other less noted Elzevirs were **ISAAC**, who managed the house at Leyden (1617-25), **PETER**, grandson of **JOOST**, at Utrecht (1667-75), and **ABRAHAM**, university printer at Leyden (1681-1712). They printed in all about 1618 books—1097 in Latin, 48 in Greek, 356 in French, 43 in Flemish, 18 in German, 27 in Italian, and 29 in Oriental languages. The Elzevir books are distinguished less by the critical preparation of their texts than by the elegance of the types and the choice grade of the paper. All the more important Elzevirs, in particular editions of the classics, are highly valued by collectors. Consult A. Willems, *Les Elzevier: histoire et annales typographiques* (Bruxelles, 1880).

**EMANATION** (Lat. *emanatio*, a flowing forth, from *emanare*, to flow forth, from *e*. out + *manare*, to drip). In theology and philosophy, the name of an ancient doctrine which considered the world of finite spirit and of matter as being an involuntary outpouring from the Divine Essence. What thus flows forth from original perfection was regarded as gradually degenerating, and this was thought to account for the origin of evil. It is interesting to notice how emanation regards the starting point of development as superior to its goal, while the prevailing tendency of evolutionism

is to reverse these values and consider developmental movement as a progress. The idea of emanation came from the East and pervaded the Neoplatonic philosophy of Alexandria (see NEOPLATONISM) and Gnosticism (q.v.), while there are hints and possibly even the germ of it in Indian philosophy and Zoroastrianism (q.v.).

**EMANCIPATION** (Lat. *emancipatio*, from *emancipare*, to manumit, from *e*, out + *mancipare*, to deliver over, from *manus*, hand + *capere*, to take). In Roman law, the liberation of a person from paternal authority (*patria potestas*) by the act of the *paterfamilias*. Paternal authority over a son was regularly extinguished only by death. Paternal authority over a daughter ended when the daughter passed, by marriage, under the hand (*manus*), i.e., into the power of a husband; but this was not regarded as an emancipation in the full sense of the term. Emancipation not only liberated the son or daughter from all parental control, but had the further effect of cutting him or her off from the rights as well as the responsibilities of the filial relation. In the oldest Roman law no such liberation was possible. The Roman father had, however, the power of selling his child as *mancipium*; and the status of a child thus sold was technically that of a slave, but practically, by ancient custom, that of a domestic servant bound out for a term of years. An ancient rule, ascribed to Romulus and repeated in the Twelve Tables, declared that a son sold three times should be free from his father. Taking advantage of this rule, the Roman lawyers devised a form of voluntary liberation. The son was sold three times in succession to a friend of the family, who, after the first and second sales respectively, set him free by manumission, just as a slave was set free, and after the third sale, by which the paternal authority was broken, sold him back to the father. The father, who at that stage of the transaction held the son, not as a son, but as a *mancipium*, then emancipated him by manumission. As the law of the Twelve Tables mentioned the son only, and not the daughter, and as this law came to be regarded as regulating emancipation rather than as furnishing the legal basis for emancipation, it was held that a daughter might be emancipated after a single sale. This form of liberating the son or daughter existed till the time of Justinian, who abolished it entirely, substituting a declaration of emancipation by the father before a magistrate.

The emancipation of a son who was married and had children did not take these children out of the grandfather's power. On the other hand, grandchildren could be emancipated, although their father remained in his father's power. Emancipation took the person emancipated not only out of the household, but out of the agnatic family, and thus deprived him of all kindred in the legal sense and of all rights of inheritance. As far as inheritance from the father was concerned, the law was changed in the last century of the Republic by edict of the prætors, who admitted the emancipated son to share in his father's estate on condition that his own estate was "collated," i.e., reckoned in as a part of the paternal estate. As far as rights of inheritance from collaterals were concerned, the emancipated person was at a disadvantage until Justinian changed the entire law of succession, and made *cognatio*, or kinship by blood, decisive.

*Teutonic law* never recognized a lifelong authority of the head of the house over his children; not only did the daughter pass out of the father's control by marriage, but the son became free from the father as soon as he set up a home of his own. This mode of emancipation was described in the Middle Ages as "Saxon emancipation" (*emancipatio Saxonica*). In modern civil law the liberation of a person from paternal authority, as from the authority of a guardian, comes with the attainment of full age; and the term "emancipation" is applied to the case where a person receives some or all of the rights of full age before attaining full age. Thus, the French law declares that sons as well as daughters are emancipated by marriage, and further provides for the emancipation of a minor with the consent of his parents at 15, and with the consent of the family council, if neither of his parents is living, at 18. Similar provisions are to be found in other European codes.

The freeing of a slave was not termed at Roman law emancipation, but manumission. See MANUMISSION; FAMILY; PATRIA POTESTAS; SLAVERY.

**EMANCIPATION, PROCLAMATION OF.** The document issued by Abraham Lincoln, as commander in chief of the armies of the United States, Jan. 1, 1863, declaring slavery abolished by military authority in all the South except Tennessee and the parts of Louisiana and Virginia then held by Union arms. For a long time President Lincoln had resisted the appeals of the radical Republicans for such a proclamation. He waited until he thought public opinion was ready for it and until he had achieved a victory and not seem the victor of a defeated combatant. After McClellan's unsuccessful campaign against Richmond he felt that the emancipation of the slaves was a moral and a military necessity for its effect upon both South and North. Antietam furnished the victory he awaited, and on Sept. 22, 1862, a preliminary proclamation was issued, decreeing the emancipation on Jan. 1, 1863, of all slaves in the States which should till then continue in a state of rebellion. In this he also stated that thenceforth, as before, the restoration of the Union should be the object of the prosecution of the war. The act, of course, carried no other authority than that which the President exercised as commander in chief of the military forces of the government. The final proclamation, in view of its purposes and effects, must ever hold an important place in American history.

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA.

#### A PROCLAMATION.

Whereas, on the 22d of September, in the year of our Lord one thousand eight hundred sixty-two, a proclamation was issued by the President of the United States, containing, among other things, the following, to wit:

"That on the 1st day of January, in the year of our Lord one thousand eight hundred sixty-three, all persons held as slaves within any State, or designated part of a State, the people whereof shall then be in rebellion against the United States, shall be then, thenceforward, and forever free; and the executive Government of the United States, including the military and naval authority thereof, will recognize and main-

tain the freedom of such persons, and will do no act or acts to repress such persons, or any of them, in any efforts they may make for their actual freedom.

"That the Executive will, on the first day of January, aforesaid, by proclamation, designate the States and parts of States, if any, in which the people thereof respectively shall then be in rebellion against the United States; and the fact that any State, or the people thereof, shall on that day be in good faith represented in the Congress of the United States by members chosen thereto at elections wherein a majority of the qualified voters of such State shall have participated, shall, in the absence of strong countervailing testimony, be deemed conclusive evidence that such State and the people thereof are not then in rebellion against the United States."

Now, therefore, I, Abraham Lincoln, President of the United States, by virtue of the power in me vested as commander in chief of the army and navy of the United States and as a fit and necessary war measure for repressing said rebellion, do, on this first day of January, in the year of our Lord one thousand eight hundred sixty-three, and in accordance with my purpose so to do, publicly proclaimed for the full period of 100 days from the day first above mentioned, order and designate as the States and parts of States wherein the people thereof, respectively, are this day in rebellion against the United States, the following, to wit:

Arkansas, Texas, Louisiana (except the parishes of Saint Bernard, Plaquemines, Jefferson, Saint John, Saint Charles, Saint James, Ascension, Assumption, Terre Bonne, Lafourche, Saint Mary, Saint Martin, and Orleans, including the city of New Orleans), Mississippi, Alabama, Florida, Georgia, South Carolina, North Carolina, and Virginia (except the forty-eight counties designated as West Virginia, and also the counties of Berkeley, Accomac, Northampton, Elizabeth City, York, Princess Ann, and Norfolk, including the cities of Norfolk and Portsmouth), and which excepted parts are, for the present, left precisely as if this proclamation were not issued.

And by virtue of the power and for the purpose aforesaid, I do order and declare that all persons held as slaves within said designated States and parts of States are, and henceforward shall be, free; and that the Executive Government of the United States, including the military and naval authorities thereof, will recognize and maintain the freedom of said persons.

And I hereby enjoin upon the people so declared to be free, to abstain from all violence, unless in necessary self-defense; and I recommend to them that in all cases, when allowed, they labor faithfully for reasonable wages.

And I further declare and make known that such persons of suitable condition will be received into the armed service of the United States to garrison forts, positions, stations, and other places, and to man vessels of all sorts in said service.

And upon this act, sincerely believed to be an act of justice, warranted by the Constitution, upon military necessity, I invoke the considerate judgment of mankind and the gracious favor of Almighty God.

In witness whereof, I have hereunto set my

hand, and caused the seal of the United States to be affixed.

Done at the city of Washington, this first day of January, in the year of our Lord [L.S.] one thousand eight hundred sixty-three, and of the independence of the United States of America the thirty-ninth.

By the President: ABRAHAM LINCOLN.

WILLIAM H. SEWARD, Secretary of State.

The effect of the proclamation on the legal status of the slaves gave rise to some discussion, but a solution of that problem became unnecessary, inasmuch as the work of emancipation in the United States was completed by the adoption of Article XIII of the amendments to the Constitution; and the reconstruction of the States in insurrection proceeded upon that basis. Consult Whiting, *War Powers of the President* (Boston, 1862). See SLAVERY; RECONSTRUCTION.

**EMANIUM.** See ACTINIUM.

**EMANTS,** ém'ants, MARCELLUS (1848- ). A Dutch writer. He was born in Voorburg, near The Hague, and studied at Leyden. He traveled extensively and from 1872 to 1880 was associated as editor with several publications. His experiences in Sweden, southern Europe, and Africa are recorded in the following works: *Op Reis door Zweden* (1877); *Monaco* (1878); *Langs den Nyl* (1884); *Uit Spanje* (1886). He is also known for his epics, which include *Lilith*, a poem in three cantos (1889); for *Godenscherming* (1883); for several dramas, among which is *Adolf van Gelder* (1887); and for his novels, among which is *Een nagelaten Bekenenis* (1895).

**EMANUEL.** See EMMANUEL.

**EMAUS,** ém'â-ûs. A borough in Lehigh Co., Pa., 6 miles southwest of Allentown, on the Philadelphia and Reading and the Perkiomen railroads (Map: Pennsylvania, L 6). It contains ironworks, furnaces, silk mills, a brick plant, a cigar and a shirt factory. The city owns its water works. Settled about 1723, Emaus soon became the seat of a Moravian church, and in 1761 was laid out as a congregational village (Gemein Ort), receiving its name from the sainted Bishop in 1859. Schools were established here in 1734, but on account of attacks by the Indians were forced to move to Bethlehem (q.v.). These schools now comprise the Moravian College at that city. Pop., 1900, 1468; 1910, 3501.

**EMBA,** ém'bâ. A river in the Russian Central Asiatic Territory of Uralsk, rising in the Mugojar Mountains. It flows in a southwesterly direction and enters the Caspian Sea by a wide estuary, after a course of 350 miles. It is partly dry during the summer season and is unnavigable. Fish abound. The principal tributary is the Temir.

**EMBALMING** (from Gk. βάλαμον, *bal-samon*, balsam, balm). The art of preserving bodies after death. The art has attained to great perfection by the ancient Egyptians, who regarded the preservation of the dead as a religious duty. Not only human beings, but also cats, ibises, ichneumons, and other sacred animals were regularly embalmed. In 1880 the mummy of King Mer-en-rê, who lived about 25 centuries before our era, was found in his pyramid at Saqqara, and its excellent state of preservation attests the efficacy of the methods of embalming used at that remote period. From time to time various improvements in the art

seem to have been introduced, and under the New Empire the processes employed were highly elaborate. At the same time certain innovations appeared: the heart was removed and replaced by a stone scarabæus, and the viscera were placed in four jars, each of which was under the protection of one of the four sons of Osiris. (See CANOPIC VASES.) Both Herodotus and Diodorus describe the methods of embalming practiced in their day by the Egyptians. According to Herodotus (c.450 B.C.), three methods were in vogue. The most expensive of these was as follows: The brain was removed through the nostrils, partly by the use of a curved metal instrument and partly by the injection of certain drugs. The intestines were withdrawn through an opening in the left flank, and the abdominal cavity, after being washed out with palm wine, was filled with myrrh, cassia, and other aromatic substances. The opening was then sewed up, and the body was steeped for 70 days in a strong solution of natron, which seems to have been a mixture of common salt, saltpetre, and sodium sulphate. After this the body was washed, elaborately bandaged in linen strips smeared with resins, and was finally placed in the coffin. This method of embalming was within the reach of the wealthy only. A second and cheaper method consisted in injecting into the abdominal cavity cedar oil (*κεδρα, kedria*), or turpentine, and steeping the body for 70 days in a solution of caustic soda. The contents of the abdomen, broken down by the injection, were then allowed to escape, and the body was ready for burial. By the third method the abdomen was washed out with *syrmace*, and the body was pickled in caustic soda for 70 days. Diodorus also speaks (towards the close of the first century B.C.) of three modes of embalming practiced by the Egyptians. The first method cost, he says, a silver talent (about \$1200), the second 20 minas (about \$400), while the third cost but "a trifle." His account agrees in the main with that of Herodotus, though he gives some additional details. According to Diodorus, a scribe first drew with a reed pen a line down the left flank of the body, and following this line the *paraschistes*, or 'cutter,' made a deep incision. The embalmers then withdrew the entrails through this incision and proceeded to embalm the body. From an examination in modern times of many Egyptian mummies, it is evident that the methods described by the classical writers were not the only ones employed. Some mummies have been merely dried in the sand; others have been treated with caustic soda or boiled in resins and bitumen, with or without the flank incision, having the brain removed through the eyes or base of the cranium, with the viscera returned into the body, placed upon it, or deposited in jars in shapes of the genii of the dead, the skin partially gilded, the flank incision covered with a tin plate, the fingers cased in silver, the eyes removed and replaced. The mummies are generally wrapped in linen bandages and placed in costly coffins. Embalming was practiced to some extent by the early Christians in Egypt, their views in regard to the resurrection being doubtless influenced by Egyptian ideas. The Guanches, or ancient inhabitants of the Canary Isles, used an elaborate process like that of the Egyptians; and desiccated bodies, preserved for centuries by atmospheric or other agencies, have been found in France, Sicily, England,

and America, especially in Central America and Peru.

**Modern Embalming.** The art of embalming was probably never lost in Europe. The development of modern methods, however, may be said to date from the beginning of the eighteenth century. It is said that arterial injection of embalming fluid for the preservation of a dead body was first practiced successfully by Dr. Frederick Ruysch, of Amsterdam (1665-1717), who also treated the internal organs with alcohol, after removing and cleansing them, replacing them finally. His secret of preservation of color and form died with him. Following him in the work of embalming came Dr. William Hunter (q.v.), the celebrated anatomist, who employed as an arterial injection a solution containing oil of turpentine, Venice turpentine, oil of lavender, oil of rosemary, and vermilion. He also removed the abdominal and thoracic organs, cleaned and injected them, soaked them in camphorated spirits of wine, and then returned them to their cavities, packed in a powder composed of camphor, resin, and nitre. This powder he also placed in all external orifices. The body was then anointed with oil of rosemary and oil of lavender and placed upon a layer of dry plaster that its moisture might be extracted from it. Bodies embalmed after this method by William Hunter or his brother, John Hunter (q.v.), in perfect condition, are deposited in the museum of the Royal College of Surgeons, London. Other physicians, chief among them being Drs. Matthew Baillie, Sheldon, and Joshua Brooks, used similar methods. Jean Nicolas Gannal (1791-1852), a French chemist, employed a solution with which he wet the body and which he injected into the carotid artery; the solution was composed of acetate of lead and sulphate of alumina, together with some form of arsenic. His son, a physician of Paris, used a similar solution, but without the arsenic and with the addition of certain essential oils. Gannal's method is much inferior to that of Suequet, of Paris, who used chloride of zinc. Falcony, of Paris, used external applications of zinc sulphate, without opening the body or injecting the arteries; after 40 days his subjects lost their flexibility and became mummified. Thénard describes Chaussier's method, by which saturation with a solution of corrosive sublimate was employed. A German preservative, which is said to render the dead body resistant of decay for several years, while it retains color, form, and flexibility, consists of alum, sodium chloride, potash, arsenious acid, and boiling water, with glycerin and methyl alcohol. This liquid is used for both saturation and injection. An impetus was given to embalming in this country by the successful work of Dr. Thomas Holmes, of Brooklyn, N. Y., who prepared and sent home many dead soldiers from the battlefields during the Civil War. Embalming is steadily taking the place of the use of ice in preserving the dead until funeral services and interment are ended. There are two reasons for its employment: (1) preservation of the body for transportation or leisurely disposal; (2) sanitation—for it is an absolute prevention of communication of infection, either before the body is buried or after it has crumbled and mingled with the earth in a cemetery. About four quarts of fluid are used for a body, some of which is injected into the arterial system, some into the cavities of the

pleuræ, peritoneum, and pericardium, and some is used for saturation. Discolorations are removed by various processes. The composition of the embalming fluids used to-day in the United States appears to be a secret known only to the undertakers' supply companies; it is believed that they contain arsenic, alkalies, and alcohol.

Consult: Pettigrew, *History of Egyptian Mummies* (London, 1834); Gannal, *Traité d'embaumement* (Paris, 1838; trans. by Harlan, Philadelphia, 1840); Suequet, *Embaumement* (Paris, 1872); Budge, *The Mummy* (2d ed., London, 1894); G. E. Smith, *A Contribution to the Study of Mummification in Egypt* (Cairo, 1906); Myers, *Champion Text-Book of Embalming* (5th ed., Springfield, Ohio, 1908); Eckles, *Practical Embalmer* (Philadelphia, 1904); id., *Sanitary Science* (ib., 1904); Nunnemaker and Dhonau, *Hygiene and Sanitary Science* (Cincinnati, 1913).

**EMBANKMENTS.** In engineering, masses of earth, rock, or other materials artificially formed and rising above the natural surface of the ground. They are built chiefly either to carry railways, common roads, canals, etc., over depressions or for hydraulic purposes, such as the formation of dams and reservoirs, or for defenses against the overflowing of rivers and the encroachments of the sea or lakes. The form and dimensions of embankments and the materials and methods of construction adopted depend upon the purpose for which the embankment is to be used. In all cases except where they are confined by external constructions, such as retaining walls, embankments are trapezoidal in section, with a broad base and a narrow top connected by sloping sides. The material employed in forming embankments varies from almost any available mixture of rocks and earth or other fragmentary material used in railway embankments to very carefully selected, finely divided earths used in forming water-tight embankments for dams, reservoirs, dikes, levees, and canals. The method of construction likewise varies from a mere dumping of the material in place to be roughly leveled off and allowed to settle under action of the elements, to a careful building up of the selected material in layers a few inches thick which are carefully compacted by ramming or rolling. Embankments for dams and reservoirs are instances where the more careful methods are employed. Embankments for railways are examples of less careful methods of embankment construction. In constructing embankments it is usually necessary, as a basis upon which to determine the cost, to calculate their volume. For preliminary estimates the methods of determination by average end areas or middle areas are used, but for more exact work the prismoidal formula is employed. Consult Johnson-Smith, *Theory and Practice of Surveying* (17th ed., New York, 1910), and Taylor, *Prismoidal Formulas and Earthwork* (ib., 1898); See DAMS AND RESERVOIRS; LEVEES; RAILWAYS.

**EMBARGO** (Sp., seizure). A legislative act or executive decree directing the detention in port of vessels, whether foreign or national. It may be for the purpose of using the detained shipping for naval operations, or in the event of some projected expedition to insure secrecy, or with a view to temporary nonintercourse with some foreign nation, or by way of reprisal. A hostile embargo by one nation prohibits the

departure from its ports of vessels belonging to another with which it is at variance, for the purpose of securing a favorable settlement of the dispute and, in case of war, of having an opportunity to make reprisals. While the right to lay such an embargo is still generally recognized, the practice is generally disapproved and is seldom employed by civilized states. A civil embargo aims at nonintercourse and is laid pursuant to plans of public policy, or for the protection of the merchant vessels of a neutral nation against the attacks of belligerents, or by its interference with a belligerent's commerce, to restrain it from acts prejudicial to the trade of the neutral power. Consult the authorities referred to under INTERNATIONAL LAW.

The first embargo in the history of the United States was laid on March 26, 1794, in retaliation for the British orders in council dated June 8, 1793, and Nov. 6, 1793 (see ORDERS IN COUNCIL), and remained in effect for 60 days. Subsequently, during the wars between France and Great Britain, successive French decrees and British orders in council drove the United States, by way of reprisal, first to the passage of a nonimportation act (April, 1806), and finally to the laying of another and stricter embargo, Dec. 22, 1807. This latter measure was intended completely to prevent American vessels from . . . foreign commerce and naturally met . . . opposition in the New England States, where the commercial element of the country was almost wholly concentrated and where, besides, a large majority of the influential classes was affiliated with the Federalist party and was thus predisposed to attack the measures of the Republicans, then in power. Though there was undoubtedly much smuggling on the part of New England merchants and shipowners, commerce suffered enormously, and the exports of the country fell from \$108,343,156 in 1807 to \$22,430,960 in 1808. The opposition, indeed, became so pronounced that in many quarters nullification was openly advocated, and stanch Federalists unhesitatingly gave their approval to doctrines closely allied to those embodied in the Virginia and Kentucky resolutions (q.v.) of Madison and Jefferson. By some, indeed, secession was openly threatened. As a measure for bringing Great Britain and France to terms, moreover, the embargo proved futile, neither power being injured to anything like the same extent as the United States; and in February, 1809, Congress, alarmed at new manifestations of popular discontent in New England, passed a resolution providing for the termination of the embargo on March 4. Nonintercourse measures were then put into force and were the chief feature of the foreign policy of the government until the outbreak of the War of 1812. After the beginning of hostilities it soon became evident that the British government would endeavor to procure fresh provisions from the New England States; and Congress again laid an embargo, Dec. 17, 1813, to remain in force until Jan. 1, 1815. On April 14, 1814, however, this embargo also was repealed. It is now pretty generally agreed that the laying of the embargo was a great political and economic mistake, and it is certain that, as a result of it, American shipping sustained between 1807 and 1815 almost irreparable damage. Consult: Adams, *History of the United States from 1801 to 1817*, vol. iv (New York,

1889-91); McMaster, *History of the People of the United States*, vol. iii (ib., 1883); Randall, *Life of Jefferson*, vol. iii (ib., 1858); Schouler, *History of the United States*, vol. ii (rev. ed., ib., 1899).

**EMBASSY** (from OF., Fr. *ambassade*, from OSp. *ambawada*, Sp. *embajada*, from ML. *ambaxiata*, *ambassiata*, *ambawia*, *ambassia*, *embassy*, from Lat. *ambactus*, servant). The mission and entourage of an ambassador accredited to a foreign state. In a popular sense all diplomatic missions are spoken of as embassies, but, strictly speaking, an embassy is a mission presided over by an ambassador as distinguished from a mission or legation intrusted to a minister, envoy, or other inferior diplomatic agent. The term "embassy" comprehends, besides the ambassador, who is its head, all of the members of his suite or official family, which always includes a secretary of legation, and often a private secretary, a chaplain, and a physician. All of these, as well as the members of the ambassador's private family, enjoy certain privileges and immunities in the state to which they are accredited. (See AMBASSADOR; DIPLOMATIC AGENT.) The term "embassy" is sometimes, like the corresponding term "legation," popularly, but inaccurately, applied to the official residence of a foreign ambassador.

**EMBATERION** (Gk. *ἐμβατήριον*, from *εμβαλεῖν*, *embainein*, to enter, from *ἐν*, *en*, in + *βαλεῖν*, *bainein*, to go). A Greek war song, sung in marching time, to the accompaniment of the flute, while the advance was being made upon the enemy. We have scanty fragments of such songs, ascribed in ancient days—without reason, however—to Tyrtæus, in anapestic measure. Consult Christ-Schmid, *Geschichte der griechischen Litteratur*, vol. i, p. 163 (5th ed., Munich, 1908).

**EMBAT'TLED**, or **IMBAT'TLED** (from OF. *en*, in + *bastiller*, to build, from *bastir*, Fr. *bâtir*, to build; confused by popular etymology with *embattle*, to range in line of battle). In heraldry, a term applied to a partition line, traced in the form of the battlements of a castle or tower, called also *crenelles*. A bordure embattled is often given as a difference to any member of a family who is, or has been, a soldier.

**EMBDEN GOOSE**. See GOOSE.

**EMBER DAYS** (AS. *ymbren-dæg*, from *ymbren*, *embryne*, circuit, from *ymb*, *embe*, OHG. *umbi*, Ger. *um*, around + *ryne*, course, from *rinnan*, to run, and *dæg*, Goth. *dags*, Icel. *dagr*, OHG. *tac*, Ger. *Tag*, day). Fast days observed at the four seasons of the year by the Roman Catholic church. The earliest certain reference to their use is by St. Leo the Great (440-61); in his time, however, they were of local Roman, not universal, observance and date from the agricultural ceremonies of pre-Christian Rome. Since Pope Gelasius (492-96) fixed the ordinations at these seasons they have been considered times of special prayer for the sending forth of worthy laborers into the Lord's vineyard. The observance of them seems to have been introduced into England by St. Augustine and into Germany by St. Boniface. Their exact date has varied; they are now the Wednesday, Friday, and Saturday after the first Sunday in Lent, after Whitsunday, after September 14, the Exaltation of the Cross, and after December 13, St. Lucy's Day. In the Church of England, the ordination of clergy generally takes place on the Sundays following the ember days. Em-



ber weeks are the weeks in which the ember days fall. Consult Duchesne, *Christian Worship* (London, 1904). See FAST.

**EMBER GOOSE** (Dan. *imber*, Ger. *Imber*, ember + goose), or **IMMER GOOSE**. A Hebrew name for the loon.

**EMBEZZLEMENT** (from *embezzle*, from OF. *imbecile*, *imbecille*, Fr. *imbécille*, weak, imbecile, from Lat. *imbecillus*, weak). The fraudulent appropriation of money or other personal property held in some fiduciary capacity, as that of agent, clerk, or servant. As a crime, the offense is purely statutory. The wrongful act of misappropriating funds or other property in one's possession being, at common law, only a civil wrong (known as conversion), the remedy for which was an action of *trover* for the damages sustained. The common-law crime of larceny was committed only by one who with felonious intent took personal property out of the possession of another. The American statutes upon this subject are based chiefly upon the English Statute of 8 Geo. IV. In addition to the provision that the article taken should not have been taken from the possession of the employer, that act required, in order to sustain a charge of embezzlement: (1) that the accused should be a clerk or servant, or a person acting in such a capacity; (2) that the property should have come into his possession "by virtue of his employment"; (3) that he fraudulently converted, or appropriated, or secreted it for his own use, without the consent or concurrence of his employer, and with intent to convert it to his own use. Although that act confined the crime to servants, clerks, and persons employed in such capacity, yet the laws are now broad enough in scope, both in England and in most of the United States, to include wrongs of this nature committed by such persons as agents, attorneys, factors, brokers, public officers, trustees of charities, directors and officers of corporations, etc. If however, the relation of debtor and creditor simply exist between the owner of the articles appropriated and the person who appropriates them, so that he who receives them may, if he choose, regard them as his own and thus make himself liable to respond to his employer for their value, the act will not be an embezzlement. If the property come into the possession of the wrongdoer in any other manner than "by virtue of his employment," his retention of it, however wrongful, cannot constitute the crime of embezzlement. The essential element of the crime in this respect is that some confidence shall be violated. Thus, if a servant, believing himself authorized to receive money for his master, but not being in fact so authorized, receive it and convert it to his own use, he does not commit the offense. By the statutes of some American States it is not necessary, in order to constitute this crime, that the property belong to the employer, so long as it does not belong to the servant or clerk and is acquired by the wrongdoer by virtue of his employment.

If a person commit the necessary act of conversion or appropriation, the presumption is that he meant to embezzle. Still there must be a criminal intent; and if it be proved that the accused honestly believed himself entitled to the property intrusted to him, however much mistaken he may have been, he cannot be convicted of the crime.

In England one indicted for larceny (q.v.)

may now be convicted of embezzlement if that crime only be proved, and vice versa. In some American States, as New York, larceny has been made broad enough to include embezzlement. The punishment prescribed for the crime is imprisonment for a term of years. This varies somewhat in different jurisdictions, the minimum term being usually not less than two years and the maximum from 10 to 15 years. Consult: Stephen, *History of the Criminal Law of England* (London, 1883); Rapalje, *Treatise on the Law of Larceny and Other Kindred Offences* (Chicago, 1892); and the authorities referred to under CRIMINAL LAW.

**EM'BLA** (Icel., possibly connected with *almr*, elm). In Norse mythology, the name of the first woman created. According to the Elder Edda, the gods Odin, Hœnir, and Lodur, when wandering on the earth, found Ask (ash) and Embla (elm) without power and without destiny. They had neither spirits, nor sense, nor blood, nor power of motion, nor fair color. Odin gave them spirit, Hœnir sense, and Lodur blood and fair color. The Later Edda gives the names of the gods as Odin, Veli, and Ve. The man they called Ask, and the woman Embla. From this pair the human race descended; a dwelling was given them in Midgard (the earth).

**EM'BLEM** (Lat. *emblemata*, Gk. *ἐμβλημα*, *emblemata*, from *ἐμβάλλειν*, *emballlein*, to inlay, from *ἐν*, *en*, in + *βάλλειν*, *ballein*, to throw). A representation of an object intended to signify or indicate to the understanding something else than that which it directly represents to the eye. The meaning of the emblem rests upon its secondary, not its primary, signification. Emblem is often used in a sense synonymous with "symbol." See SYMBOLISM.

**EMBLEM'ATA**. The ornaments in relief with which gold and silver vessels were decorated by the ancients. These figures were generally executed either in the precious metals or in amber and could usually be taken off at pleasure. They were also called *crustæ* by the Romans.

**EM'BLEMENTS** (OF. *emblaement*, from *emblaer*, *embleyer*, *emblader*, Fr. *emblaver*, to sow with grain, from ML. *imbladare*, to sow with grain, from Lat. *in*, in + ML. *bladum*, grain, from Lat. *ablatus*, p.p. assigned to *auferre*, to bear away, from *ab*, away + *latus*, OLat. *tlatus*, carried, *tollere*, Gk. *τῆλαι*, *tlênai*). Growing crops of cereal and vegetable products raised by the labor of the cultivator. Fruits of trees growing on the land and grass growing from the ancient roots are not emblems. By the common law, when a tenant for life died after the planting and before the reaping, his personal representative was entitled to the crops. In England and the United States a tenant for life or tenant at will whose term may be unexpectedly brought to a close is entitled to reap the crop which he has sown and to enter the lands after the expiration of the term to remove the emblems. The right of life renters in Scotland to reap the growing crop resembles the English right to emblems. In America emblems are sometimes known as "way-going crops." See LIFE ESTATE; TENANCY AT WILL.

**EM'BOLISM** (Lat. *embolismus*, embolism, from Gk. *ἐμβόλιμος*, *embolimos*, intercalated, from *ἐν*, *en*, in + *βάλλειν*, *ballein*, to throw). The term employed by pathologists to designate the plugging up of a vessel by a clot of coagulated blood fibrin, by a detached shred of a

morbid growth from a diseased cardiac valve, detached atheromatous plates, fat globules, portions of tumors, masses of bacteria, or parasites. Clots, or portions of a clot, may be transported by the blood current from the venous system to the right side of the heart and block up the pulmonary artery either entirely or in part; if the occlusion is entire, sudden death is produced; if it is only partial, gangrene, or localized pneumonia, commonly ensues. Similar accidents may happen in the arterial system. A detached fragment of a diseased tricuspid or aortic valve of the heart, or a separated fragment of coagulated fibrin, may be driven onward in the blood current and enter and occlude some of the cerebral arteries, causing softening of the brain by cutting off the due supply of nourishment. It is a frequent cause of sudden death, carelessly ascribed to "heart failure," a recognized cause of apoplexy (q.v.), with subsequent paralysis. Consult: Geigel, *Gehirnhämorrhagie und Embolie* (Berlin, 1902); A-chaff, *Beitrag zur Thrombosefrage* (Leipzig, 1812); Starr, *Organic and Functional Nervous Diseases* (London, 1913). See THROMBOSIS.

**EMBOLITE.** A chlorobromide of silver occurring in greenish isometric crystals. It is one of the principal ores in the Chilean silver mines. It is also found at Eulalia, Mexico; at Coloal, in the Province of Gracias, Honduras; and in Victoria and New South Wales.

**EMBOSSING** (Fr. *embosser*, from *en*, in + *bosse*, hump, bump, OHG. *bōzo*, tuft, from *bōzan*, Ger. *bossen*, to beat). The art of producing figures in relief upon various substances, including paper, leather, wood, and metals. This is usually effected by pressing the substances into a die, the kind of die and mode of applying being modified by the nature of the design and of the material to be embossed. (For the stamping of sheet metal, see DIES AND DIE SINKING.) Embossing of metal, however, may also be done by hand by beating up the metal from the underside, in which case the process is called *repoussé* work. See REPOUSSÉ.

Paper and cardboard are embossed with dies in a similar manner, but the dies are frequently of brass, sometimes of copper electrically deposited and suitably backed. The counterdie is commonly made of soft metal, card, or millboard, pressed into the metal intaglio die until a sharp impression is produced. The paper or card is well damped and a fly press is generally used. The leather or cloth for bookbinding is embossed in this manner, the counterdie being usually made by gluing several pieces of millboard together and gluing them to the upper bed of the press, then stamping these into the lower die until a perfect impression is obtained. The embossing press designated for impressing the medallion upon postage envelopes is a very elaborate and beautiful machine, which inks the die itself, and with the aid of two operatives to place and remove the envelopes embosses 60 envelopes in a minute. When large surfaces of textile fabrics, such as table covers, etc., have to be embossed, the fabric is compressed between rollers, one being of metal upon which the device is sunk like a die; the counter roller or bed cylinder is of paper covered with felt; this yields sufficiently to allow the fabric to be pressed into the die cylinder. A third smooth metal roller is commonly used to press out again the impression made upon the bed cylinder; this acts upon the bed cylinder on the side from which the fab-

ric emerges. Paper is sometimes embossed in this manner; and the flattening roller may be dispensed with if the cylinders are sufficiently accurate in their diameters for the pattern always to fall on the same place at each successive revolution. Leather embossed in high relief for ornamental purposes is sometimes stamped with dies of type metal or electrically deposited copper, the leather having first been softened in water. Several methods have been invented for embossing wood. Sometimes hot molds are pressed upon the wet wood, which burn in the pattern, the charcoal being afterward removed. In some machines engraved rollers are used instead of stamps, the wood being steamed and passed between the rolls while hot. In another method the wood is pressed and rubbed with a blunt instrument, the surface yields, and a depression of some depth is made; if the wood be now soaked in water, the depressed portion will rise to its original level. Only the surface in those parts that are to be finally in relief is rubbed down. The rest of the surface is planed down even with the depressions and the wood soaked; this causes the compressed parts to swell back to their original level and stand out in relief against the planed surface. Embossing in needlework is effected by embroidering over figures padded with wool felt or other material.

**EMBOWED**, *ēm-bōd'*. The heraldic term for anything which is bent like a bow. A sinister arm couped at the shoulder is embowed. When the arm is turned the reverse way, it is said to be counterembowed.

**EMBRA'CERY** (from OF. *embraser*, *embracer*, Fr. *embraser*, to kindle, from *en*, in + *braise*, live coals, from Dan. *brase*, to fry, Icel. *brasa*, to harden by fire). The criminal offense of attempting to influence improperly a juror in a civil or criminal action, or one summoned as a juror, or an arbitrator, or a referee in respect to his verdict, award, or decision. Any means of swaying his judgment other than evidence or argument in open court is deemed improper. Hence a juror who attempts corruptly to influence his fellow jurymen commits this offense. As the gist of the crime is the attempt, it is not necessary that a juror, arbitrator, or referee be actually affected by the criminal's acts, nor that a verdict or decision be rendered in accordance with the improper solicitation. It is generally spoken of as a common-law misdemeanor, although it has been dealt with by statute in England since 1360 and is defined by statutes in this country. As a crime against public justice it is recognized everywhere as a heinous offense and is punishable by fine or imprisonment. Consult the authorities referred to under CRIMINAL LAW.

**EMBRASURE** (Fr. *embrasure*, from OF. *embraser*, to skew, from *en*, in + *braser*, to skew). An aperture, in the wall or parapet of a casemate or other fortification, through which guns are fired. A similar smaller opening for the use of small arms is usually called a loophole, or notch. A loophole has overhead cover; a notch has not. A crenelle (Lat. *crena*, a notch) is an embrasure in a battlement. Embrasures are usually so skewed or played as to obtain the maximum arc of fire with the maximum protection to the firer. The bottom of an embrasure is called the floor, or sole; the sides, the checks; the narrowest part of the opening, the throat; the angle of divergence of the sides, the splay.

**EMBROID'ERY** (from OF. *embroder*, from *bord*, border). The art of ornamenting cloth and other materials with needlework. But flat ornaments *woven* directly into the warp, like those on the fragments of linen robe found in 1903 in the tomb of Thothmes IV (fifteenth century, B.C.), and in many Coptic and Peruvian textiles, are tapestry; and embroidery on net and cutwork belongs with lace.

**Historical Development.** Embroidery in its crudest form is one of the oldest of the decorative arts. It was probably applied to skins before the art of spinning and weaving had been developed, and almost as soon as the use of the needle and thong for joining together skin garments was developed. Among the primitive tribes of Central Africa the girls embroider skins with figures of flowers and animals, bright shells and feathers also being used in their decoration. The Laplander embroiders upon his reindeer-skin garment with a needle of reindeer bone, thread of reindeer sinews, and appliqué of strips of hide. Of the textiles of ancient Babylon and Assyria no fragments have survived. But the Nineveh mural reliefs in the British Museum show Assyrian robes with both geometrical and floral ornament, and the famous relief now in the Louvre from the palace of Darius I (521-485 B.C.) shows Persian robes with diaper pattern. These ornaments, like those of the hangings of the tabernacle described in the Book of Exodus, may have been either embroidery or tapestry. Among the ancient Greek textiles exhumed from Crimean graves are both tapestries and embroideries, now preserved in the Hermitage at St. Petersburg. One of the embroideries attributed to the fourth century B.C. is in colored wools on wool and shows a cavalier with honeysuckle ornament. Also among the Romans embroideries and tapestries were used side by side.

Marzial, in the first century A.D., writes that the embroideries of Babylon have been driven out of fashion by the tapestries of Egypt (*victa est pectine Niliaco iam Babylonis acus*). After Byzantium (Constantinople), at the beginning of the fourth century A.D., was established by Constantine as the capital of the Roman Empire in place of the city of Rome, embroideries elaborate with gold were used on secular as well as on ecclesiastical robes. Preserved in the sacristy of St. Peter's at Rome is a blue silk garment, probably Byzantine work of the twelfth century, known as the "dalmatic of Charlemagne." Embroidered on the front is the Triumph of Christ, on the back the Transfiguration, both with captions in Greek. The comparatively brief textile prominence of Palermo in Sicily, with Saracenic workmen, under Norman kings, is commemorated by richly embroidered Imperial coronation robes preserved at Vienna and described in Bock's *Kleinodien*. In the library of the English cathedral of Durham are fragments found in the tomb of St. Cuthbert, embroidered in gold in the tenth century.

In the public library of the French town of Bayeux is preserved the famous Bayeux Tapestry (q.v.), which is not a tapestry at all, but an embroidery. Very beautiful are the Italian embroideries of the fourteenth century. One of the finest, a richly colored altar frontal in gold, silver, and silk, preserved in the Florence Archaeological Museum, is signed *Jacobus Cambi de Florentia me fecit MCCCXXXVIII* (James

Cambi of Florence made me in 1338). Among fifteenth-century Italian embroideries are those in the Opera del Duomo in Florence picturing the story of St. John, attributed to the design of Antonio Pollaiuolo. In the Cluny Museum is a sixteenth-century Italian embroidery after Raphael which pictures the Israelites worshipping the golden calf. It is an oval, 20 by 32 inches, the only piece remaining of a furniture set with gold ground, picturing 40 scenes from Hebrew history, preserved at the abbey of Saint-Denis until the French Revolution. In early Spanish embroideries Moorish influence was strong, and East Indian influence in Portuguese embroideries. Early German embroideries cling close to Byzantine traditions, keeping the draperies flat without folds and covering them with pattern.

As in tapestry, so also in embroidery, the Germans made much use of long narrow bands to hang above choir stalls, with story told in sequence of scenes and descriptive captions. An eleventh-century Danish embroidery is the one, in the church at Odense, covering the relics of King Canute (1080-86).

In the Netherlands in the fifteenth century, under the Duke of Burgundy, embroidery flourished, as did tapestry and painting, and both textile arts utilized the designs of the best painters. Among the best examples of the period are the *ornement de la toison d'or*, a set of vestments now in the Hof-Museum at Vienna; and the red velvet cope, with orphreys and hood picturing the seven works of mercy, in the museum at Tournai. In the seventeenth century and after, the embroideries of Holland were much influenced by the Dutch conquests in the East Indies, and many embroideries were produced in the Far East, under Dutch direction, for exportation to Holland.

An exquisite French embroidery of the fifteenth century in the Museum of Chartres is in the form of a triptych with a Pietà in the middle, St. John the Evangelist on the left, and St. Catharine of Alexandria on the right. In the sixteenth century in France were produced many ornamental embroideries without figures—velvet, satin, or silk florals and scrolls on woolen. Splendid examples of seventeenth-century French embroidery are the vestments given by Louis XIII to the cathedral of Reims and still preserved there. Louis XIV not only had many embroiderers attached to his household, but also installed others at the Gobelins, whose duty it was to make draperies and furniture coverings; among these embroiderers were Simon Favette, whose specialty was figures, and Philibert Bolland, whose specialty was landscapes. In the thirteenth century English embroidery was celebrated throughout western Europe, and the phrase *de opere anglicano* occurs constantly in inventories. The most famous example is the Syon cope in the Victoria and Albert Museum at South Kensington. It is covered with embroidered medallions picturing Christ on the cross, Christ and Mary Magdalen, Christ and St. Thomas, the death of the Virgin, the burial and coronation of the Virgin, St. Michael, and each of the Twelve Apostles separately. The spaces between the medallions contain six-winged cherubim. The figures are in gold, silver, and colored silk, with medallion grounds of green silk embroidery between medallions. The orphrey with coats of arms and the lower border are of later date. The cope takes its name

from the convent of Syon, near Isleworth, to which it formerly belonged, being taken to Portugal at the time of the Reformation and not brought back to England until the nineteenth century.

During the fourteenth and fifteenth centuries many excellent ecclesiastical embroideries were produced in England, and in the sixteenth century the costumes of the nobility were magnificent with embroidered florals. Black work, done in silk or linen, was popular in the reign of Elizabeth. So also was petit point, sometimes called tapestry or needlework tapestry, an all-over cross stitch on coarse canvas in imitation of woven tapestry.

Richly costumed figures were introduced, often in small medallions in fine point on a ground of coarse point. During the seventeenth and eighteenth centuries petit points in floral and purely ornamental designs continued to be made in England for use as draperies and furniture coverings and sometimes as framed pictures. During the latter half of the nineteenth century embroidery shared the revival of interest in decorative art (q.v.), and artists like William Morris, Burne-Jones, and Walter Crane supplied designs. But the majority of embroideries made to-day are either copies of ancient ones (some of them intended for sale as antiques), or purely ornamental patterns produced at small expense on the bonnaz or other machines in Switzerland, Saxony, and elsewhere.

The people of the Orient continue, as in ancient times, to excel in the art of embroidery, and the woolen shawls of Cashmere are still world famous. The Chinese are perhaps the most laborious and elaborate hand embroiderers, their best work being in silk. The figures are either in colored silk alone or combined with gold and silver thread; sometimes the figures of men, horses, dragons, and the like are outlined in gold cord and filled up with shaded silk. The Persians, Turks, and Hindus use, besides silk and gold and silver threads, beads, spangles, pearls, and precious stones. Some of the Oriental embroideries include a still wider range of materials. Feathers are largely and very tastefully employed, and also the skins of insects, the nails, claws, and teeth of animals; nuts, pieces of fur, and skins of serpents are among the materials drawn upon. Coins, which are so commonly used as ornaments of the hair of unmarried women, are also worked into embroidery on their dresses. The Indian women embroider with their own hair and that of animals.

**The Process of Embroidery.** The tools of the embroiderer are the simplest, consisting of needles to draw the different kinds and sizes of thread through the work, a frame in which to hold the material (which may be omitted in small pieces of work), and scissors to cut the thread. A stitch is the thread left on the surface of the cloth after each ply of the needle. The most common forms of canvas stitch, with the needle passing through the interstices of warp and weft of the canvas, are cross stitch, tent stitch, Gobelin stitch, Irish stitch, plait stitch. Crewel stitch is a diagonal stitch used in outlining. Some of the other principal stitches are chain or tambour, herringbone (so called because of its resemblance to a fish's backbone), buttonhole, feather, rope, of which the French knot is a complicated form, satin, long and short, darning, and running stitch. About the twelfth century the modeling and padding of figures became

common; i.e., embroidery was performed by sewing onto the material as well as into it. Hence we have the couching stitch, used when one thread is sewed on with another; and appliqué work, where one piece of cloth is sewed onto another. To give effectiveness to the appliqué work, the figures are often padded.

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**EMBRUN**, an'bren'. A town of France, in the Department of Hautes-Alpes, situated on a rock plateau, 2850 feet above sea level on the right bank of the Durance, 25 miles east of Gap (Map: France, S., L 4). The town is fortified and has an imposing appearance. The principal building is a cathedral of Notre Dame, a Gothic edifice, dating from the eleventh century, surmounted by a lofty Romanesque tower. There are also the archiepiscopal palace, now used as barracks, a college, and a hospital. Embrun manufactures broadcloth, counterpanes, hats, cotton yarn, and leather, and has a fair trade in farm implements. Pop. (commune), 1901, 3505; 1911, 3556. Embrun was the ancient Embrodunum, capital of the Caturiges, and an important Roman station. As early as the fourth century it was the seat of a bishop and, from the ninth century to the beginning of the nineteenth, of an archbishop. It was burned by the Moors in 966, again in 1573 during the religious wars, and in 1692 by the Duke of Savoy.

**EMBRYO** (from Gk. ἐμβρυον, *embryon*, embryo, from ἐν, *en*, in + βόειν, *bryein*, to swell). An undifferentiated being in a rudimentary condition, or the condition from which an organized being may be developed. In botany, the term is applied to the germ which forms within the ovule on fertilization, and which increases to become the principal part of the seed. The perisperm of the seed, being regarded as a mere store of nourishment for the embryo, is not considered to be part of the embryo; while the cotyledons are considered as essentially belonging to it, together with the plumule, the radicle, and the connecting parts. In animal physiology the term is applied to the unborn young from the time the impregnation of the ovule occurs up to the time of birth, thus including the fetus (q.v.). Larvæ and pupæ, as those of insects, however, are not considered to be embryonal forms. (See LARVA.) In mammals the embryo's existence begins with the formation of the male pronucleus, which consists of the head of a spermatozoon which has penetrated the zona pellucida and perivitelline space of an ovule and, entering the yolk, has lost its tail and middle portion and has enlarged as a result of absorption from the surrounding material. Around each pronucleus a clear spot is formed. Conception takes place when this penetration and initial change occur. From this spot protoplasmic lines radiate, forming the aster. The fertilized ovum is termed the oöperm. The next step in the development of the embryo is segmentation of the oöperm, i.e., active division of the yolk. A groove forms, dividing the oöperm into two parts. A second groove, appearing at right angles to the first, subdivides the original parts into four. Similar division follows, into 8, 16,

32, and still more numerous parts. A cleft filled with clear fluid makes its appearance in the interior of the mass, and this is called the segmentation cavity. A thickening of a part of the wall of the ovum (now termed a vesicle) appears, oval at first, pear-shaped later. This structure is called the embryonic area, or germinal area, and from this the young animal develops in successive stages. An interesting embryonal structure is the amnion. This is developed from the upper leaf of the vesicle membrane, which arises in a ridge about the embryo. This ridge, by a continuous growth upward, arches over the back of the embryo, and its opposing edges meet and unite. This enveloping membrane is called the amnion. Between it and the foetus appears the amniotic fluid. In some instances a piece of the amnion tears off from the rest of the membrane, enveloping the head of the child as it emerges from the vagina. Such a portion of the amnion is called a caul.

There are many foetal conditions which are modified about the time of birth. For example, the circulation of the blood of a human embryo differs in many important respects from that of the adult. In the foetus the blood returning from the placenta by the umbilical vein divides into two currents. One of these passes through the ductus venosus to the inferior vena cava and thence to the right auricle of the heart, while the other proceeds to the liver through the hepatic vessels and thence to the right auricle. A limited supply of blood is forced into the right ventricle during contraction of the heart, while the greater part of it passes from the right auricle through the foramen of Botall (foramen ovale) into the left auricle. From the right ventricle some blood passes through the pulmonary artery, but most of it proceeds through the ductus arteriosus into the aorta. In the aorta this blood mixes with that coming from the left auricle and pulmonary veins. Blood is returned to the placenta by the umbilical vein. After birth obliteration of the umbilical vessels takes place. The ductus venosus becomes a fibrous cord, the foramen between the auricles closes, and the ductus arteriosus becomes also obliterated. For other developmental processes in the growth of the embryo, see EMBRYOLOGY; EMBRYOLOGY, HUMAN.

**EMBRYOLOGY** (from Gk. *ἐμβρυον*, *embryon*, embryo + *-λογία*, *-logia*, account, from *λέγειν*, *legein*, to say). That branch of biological science which deals with the formation and development of individual organisms. The starting point of development is a germ cell, which may be an egg, or a bud, or a fragment of the body of another individual. But all processes of development, being due fundamentally to the same causes, present sufficient similarity to be classed together as "embryological processes."

A germ cell, or sexual cell, may be generally defined as any cell which can, either alone or by fusion with another cell, reproduce the entire organism. The germ cell is, on the one hand, a specialized cell, told off for reproduction, and, on the other, an undifferentiated one, because it has the capacity of giving rise to the whole body. Sexual germ cells are of two kinds, essentially alike in the beginning, when they react similarly to microchemical agents; but later they gain a chemical difference. The one kind acquires a great size, deposits much yolk in its protoplasm, remains passive, and is an

egg; the other remains of small size, but gains a powerful locomotor organ, called a tail lash or flagellum, and is a spermatozoön.

**Unicellular Development.** At the outset it may be well to consider a case of development in the Protozoa, or unicellular animals, in order that we may learn to distinguish between the essential and the secondary in the process. We may take as a type *Podophyra*, one of the Suctorians. *Podophyra* produces germs of new individuals by the nipping off from the cell body of a spherical mass, including a nucleus. At the time that it is set free the germ possesses a girdle of cilia by means of which it swims about. It grows, i.e., increases in size. Finally it becomes attached at a point on the equator; becomes elongated, forming a stalk; develops sucking tentacles at the upper extremity of the body, and becomes an adult *Podophyra*. It is to be noted that: 1. The germ grows, and of course without any cell division occurring. 2. On the whole it becomes more complex as development proceeds; it is differentiated. 3. During development the embryo assumes various activities for which its organs fit it; it is adapted at every stage to meet the environmental conditions of that stage. Growth, differentiation, and constant adaptation to environmental conditions seem to be the essential characters of development.

**Multicellular Development.** In the Metazoa, in which the body is multicellular, the process of cell division has to be added to the developmental processes, but this may be regarded as a concomitant of the great size of the body, which demands nuclear material in every part. Here the germ cells may take the form either of an egg or of a spermatozoön.

**Evolution of the Egg.** The egg, or ovum, is the female reproductive cell especially modified for reproduction by being laden with a large amount of yolk, intended as food for the embryo. The spermatozoön is the male reproductive cell, specialized in the direction of rapid locomotion, since it has to move to reach and pass into the passive egg. The egg has evolved from a condition in which the two reproductive cells (or gametes) were alike (*Paramecium*, *Spirogyra*). In other species the gametes are of different sizes, although both are motile. They are called macrospore and microspore. The former correspond to eggs and the latter to spermatozoa. In higher species, as in *Volvox* and the brown seaweeds, the macrospore becomes still larger and loses its motility. It has become a typical egg. Its increased size is due to the increased amount of food material stored in it.

**Development of the Egg in the Individual.** Eggs, like spermatozoa, arise from "primordial germ cells," which are early differentiated from the body cells and are at first of no definite sex. Only later, frequently under the stimulus of food, do the germ cells in certain individuals become male (spermatozoa), in others female (ova). In coelenterates the germ cells arise from either ectoderm or endoderm; in the higher groups from the lining of the body cavity. The primordial germ cells that are destined to form eggs become intimately associated with the adjacent tissue, from which they receive nutritive material and in consequence grow rapidly. At the same time the yolk material, which is composed of spherules united by egg plasma, is stored away in definite parts of the egg in the case of

those eggs that have much yolk. During this period the nucleus gets very large and has received the name of "germinative vesicle."

The egg is a cell and as such has nucleus and cytoplasm. It is usually invested by one or more membranes, especially when it is discharged from the body to develop free. In respect to the amount and distribution of yolk, eggs may be classified as (1) alecithal, or with little yolk and that evenly distributed; (2) telolecithal, or with yolk concentrated at one pole, e.g., the hen's egg; (3) centrolecithal, or with yolk at the centre, e.g., the eggs of most arthropods. See Egg.

The number of eggs that ripen at one time is variable in different species of animals. In many mammals, as in man, there is usually 1; in other mammals, 2 to 10. In birds the number varies from 1 to 20. Land turtles may lay 40 or 50 eggs. Many fish deposit several thousand eggs at one time.

**Reduction Division and Polar Globules.** Certain important changes in the nuclear structure of the egg precede fertilization. The process of fertilization would, if unrestrained, cause an enormous multiplication of chromosomes (see CELL) in descending generations. This is averted by the fact that, previous to or coincident with fertilization, and after the egg has acquired its characteristic great size, one or more (usually two) parts are cast out or segmented off by a sort of modified cell division from the egg. This casting out of the polar globules is the final act in the maturation or preparation of the egg for fertilization. It is an unequal cell division, since the polar globules are many times smaller than the egg. The division by which the polar bodies is produced is known as reduction division. The first polar body may divide at the time the second is extruded, so that we have as a result of maturation three abortive eggs and the mature egg proper, which, when fertilized, develops into the embryo. Up to the time of the formation of the polar bodies the number of the chromosomes is the same as occurs in the somatic cells. As the cell gets ready for maturation, however, the number of chromosomes is reduced to half the usual number, and each of the two chromosomes is split in half at the time of each polar globule. The polar bodies soon perish.

In the development of the spermatozoön a similar reduction occurs, but in the process no cells are destroyed. The result of reduction is that the ripe germ cells contain only one-half the number of chromosomes possessed by the cells of the body. This number is then restored in fertilization. The interpretation of reduction is obscure. As already suggested, it will permit of the union of new chromosomes without increase in amount. It has been suggested by Weismann that the process has this additional significance, that variation is produced in that certain of the parental qualities are eliminated from both sex cells, so that the combination resulting from fertilization will be different for every individual.

**Fertilization of the Ovum.** The eggs of most animals and plants require, before they begin their development, that a spermatozoön should penetrate into them. This act is known as fertilization.

**General Facts and Conditions.** The ovum being yolk laden, or embedded in nutritive material, is passive, and the spermatozoön has to

come to it. In many of the lower aquatic plants and animals the fertilization occurs in the water into which both kinds of sex cells have been thrown. In the higher plants the ovum is deeply buried in the maternal tissues, and in most land animals it lies in the oviduct at the time of fertilization. In plants the pollen grain sends down to the ovule a tube which conveys the spermatozoön, and in animals the spermatozoön reaches the egg in the oviduct by virtue of its locomotive capability. The egg fertilized in the oviduct is then either extruded, "laid," to develop outside of the body, or it undergoes its embryonic development within the mother.

**Polyspermy.** In the fertilization of most animals normally only one sperm cell enters each egg, but more may do so. The entrance of the first sperm cell causes the formation of a membrane, or the closure of the micropyle, or perhaps affects the egg chemically, so that all other sperm cells are excluded. In rare cases, however, several spermatozoa gain entrance to an egg. This is called polyspermy and, it is said, results in an abnormal development of the egg, such as double cleavage, and soon ends in arrested development. In the eggs of certain insects and elasmobranch fishes polyspermy is frequent and normal, but in these cases only one of the sperm cells normally unites with the egg nucleus. The supernumerary ones live for a time and may even divide, but their ultimate fate is obscure.

**Cytological Details.** Fertilization consists essentially of mixing together living matter from two individuals—living matter which is therefore dissimilar. This interpretation of the significance of fertilization is of rather recent date. The early embryologists thought the sperm gave a stimulus to, or "animated," the egg, and it was long thought that the fluid of the sperm and not the spermatozoön was the "fertilizing" agent; the spermatozoa, indeed, were regarded as parasites. It is now known that the essence of fertilization is the union of two cells, and probably especially the union of their nuclei; for the head of the spermatozoön is composed almost wholly of the nucleus, and it is especially the head that penetrates into the egg. The head is at first very small compared with the nucleus of the egg cell, but it rapidly swells with water as it enters the egg, and when the nuclei unite they are of about the same size. The two nuclei contain the same number of chromosomes (see CELL), so that when they unite the number of chromosomes is doubled in the nucleus, half being derived from the mother and half from the father. Thus maternal and paternal qualities are united in the fertilized egg and are united in equal amounts. This accounts for the equality of inheritance by the offspring from the two parents. In plants the fusion of nuclei derived from the ovule and from the pollen grain occurs in a fashion exactly comparable with that of animals. The pollen grain typically contains two nuclei, of which the second has been seen in some cases to unite with a second nucleus of the ovule, viz., the endosperm nucleus. As a result of this union, those structures of the seed that are derived from the endosperm seem to derive their qualities from the two parents. This result is most striking when the parents belong to different species, characterized by different kinds of endosperm.

**Phylogenetic Origin of Fertilization.** The periodical union of two cells is seen even among

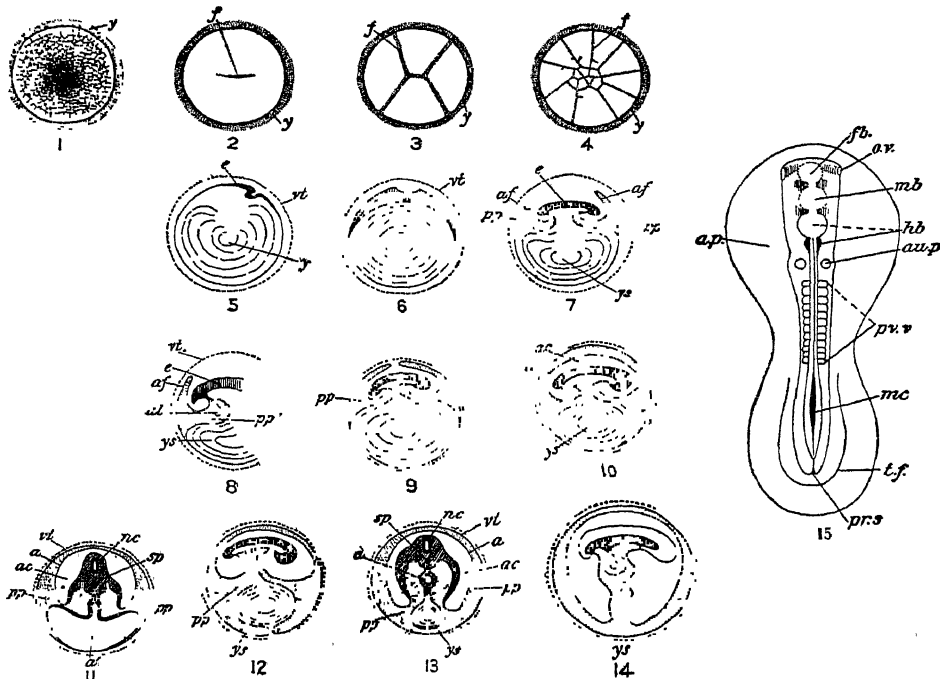


the lowest animals and plants. In some cases the union is a permanent one, followed by rapid cell division and the production of new individuals. Sometimes, however, the union is a temporary one and is characterized only by the presence of nuclear material. It is a striking fact that even in the Protozoa a reduction of the chromatic material occurs before fertilization. It is clear, then, that a fertilization process is one of very great physiological importance to organisms.

**General Sketch of Egg Development in Animals.** Since the egg is a single cell, it

In eggs with unequal segmentation the blastula is formed of several layers of cells, and the hollow (the segmentation cavity) is partly filled with large yolk cells. In eggs, such as the hen's egg, that have much yolk and undergo partial cleavage, the cleavage cavity is reduced to a fluid-filled fissure bounded above by several layers of cells and below by yolk (see below—account of development of a chick).

**Gastrula Stage.** It is necessary next that the digestive cells should come to line a digestive sac, while the sensory and protective cells remain on the outside of the germ. This is



EMBRYOLOGY OF THE FOWL.

1. Earliest stage: surface of the germinal disk of an egg, showing initial segmentation, which begins at the centre and spreads towards the periphery, but does not quite reach the periphery. 2. First appearance of the groove or furrow (*f*). 3. Other furrows (*f*) appear, dividing the surface into four irregular areas, each representing a rounded mass. 4. Additional furrows (*f*) branch off and extend to the periphery, dividing the surface into still larger peripheral areas. This process continues, as indicated by the beginning of new furrows. The resulting pattern is the matured surface of the egg. 5, 6, 7, 8, 9, 10. Longitudinal sections, the small (head) end of the egg being at the top. 11. A transverse section through the centre of the embryo, showing the cerebrospinal marrow (*sp. m.*) and the downward growth of the body walls on each side; also the beginning of the pleuroperitoneal canal (*a'*). 12. Longitudinal section at a more advanced stage. 13. Transverse section after the formation of the pleuroperitoneal canal (*a'*). 14. Longitudinal section at this stage. Lettering: *ap*, area (area pellucida) of the germinal disk surrounding the embryo, which has formed about the line of the primitive furrow (see Fig. 2); *fb*, *mb*, *hb*, vesicles of the fore, mid, and hind brain; *pr.v.*, protovertebrae; *mc*, medullary canal, in the sacra region; *pr.s.*, hinder part of the "primitive streak," and of the amnion.

must divide repeatedly to give rise to the multicellular body. These early cell divisions of the egg constitute cleavage, and the cells are called cleavage spheres. After 8 or 16 cells have arisen, a central cavity begins to appear surrounded by these cells. The protoplasm exists as a wall around this cavity until 100 or more cells have arisen. The whole embryo at this stage is the "blastula," and the cavity is the blastula cavity. The individual is now a hollow sphere, frequently ciliated and capable of locomotion in water. In the simplest cases it is composed of one layer of cells and is the result of total segmentation of eggs not laden with yolk.

effected in a variety of ways (mentioned more particularly later), the simplest of which is the pushing in of the blastula wall at one pole, as one might push in the wall of a hollow tennis ball. This is the act of "invagination." The invaginated layer partly or wholly obliterates the blastula cavity; and a new cavity opening widely to the exterior is formed—the "gastrula" cavity, or primitive food cavity. This stage is known as the gastrula stage. It corresponds essentially to the adult condition of coelenterates. The outer layer in both the gastrula and the adult coelenterate is called ectoderm, or epiblast; the inner layer, entoderm, or hypoblast. From

the ectoderm are developed later by differentiation various organs, such as the nervous system, various sense organs, feathers, hair, and nails; while from the endoderm arise not only the digestive canal, but all its outgrowths, such as lungs, liver, etc., and also the notochord of vertebrates.

**Germ Layers.** In the higher animals the gastrula stage is quickly followed by one in which loose cells are formed that migrate into the blastula cavity; in their totality these migratory cells are called mesenchyme. Very often, too, especially in the higher forms, a double layer of cells, lying in contact with the ectoderm and endoderm respectively, is formed between the two primitive layers. This is called the mesoderm. The cavity in the mesoderm is the true body cavity, or coelum. The layers, ectoderm, endoderm, and mesoderm, are the so-called germ layers. The theory that they are homologous (i.e., strictly comparable) in all animals where they occur, and that they always give rise to the same organs, is the germ-layer theory—one that held sway in the last quarter of the nineteenth century. It has been essentially modified and partially abandoned in the face of facts.

By the time the germ layers are established the embryo in many cases, especially of aquatic animals, frees itself from the egg envelopes and becomes free living; this constitutes the larval stage. The larva is often very different from the adult in form and habits and is adapted to its peculiar environment. After living for a longer or shorter period as a larva, the embryo undergoes a rapid change of form, called metamorphosis (q.v.), which leads to the adult condition. The egg development of plants differs from the above in the absence of blastula and gastrula cavities and of membranes; the germ is a solid cell mass. We shall now consider in more detail the different stages in development.

**The Media in which Development Occurs.** In the lower invertebrates, fishes and *Amphioxus*, the egg develops chiefly in the water, into which the ripe egg and sperm are both thrown. In other cases, however, the embryo is especially protected by some means for a certain time during early development. Whether the egg develops away from the mother or in connection with the maternal tissues has a great influence upon development. In the higher plants the embryo is embedded in the maternal tissues.

**Cleavage.** The nature of cleavage depends upon the disposition and amount of yolk in the egg. The kinds of cleavage are classified as follows:

I. Complete division—holoblastic cleavage.

(1) Alecithal eggs (with little or evenly diffused yolk)—cleavage equal.

(2) Telolecithal eggs (with yolk lying towards one pole)—cleavage unequal.

II. Partial division—meroblastic cleavage.

(1) Telolecithal eggs—discoidal cleavage.

(2) Centrolecithal eggs (with yolk at centre)—superficial cleavage.

Equal cleavage is characteristic of sponges, some coelenterates, many worms, echinoderms, some mollusks, tunicates, *Amphioxus*, and the higher mammals. Unequal cleavage is characteristic of many coelenterates, worms, and mollusks, the lower fishes, and amphibians. Discoidal cleavage is found in cephalopod mollusks, elasmobranch and teleost (bony) fishes, reptiles,

birds, and the lowest mammals. Superficial cleavage is found in most arthropods. When the egg cell is not completely cleft (partial division), the "cleavage spheres" are not well defined basally, and the later stages are complicated and deviate from the typical conditions described above.

**Gastrulation Reconsidered.** Three principal types of gastrulation are recognized among animals: (a) *Invagination*, which, as the typical process, has been already referred to. In partial cleavage the yolk-laden cells cannot be pushed into the small cleavage cavity, and under these circumstances the ectoderm grows over the endoderm and gradually surrounds it completely; this process is known as "epiboly," in contrast to the typical embolic invagination that occurs in alecithal eggs. (b) *Delamination*. The cells of the one-layered germ divide into a superficial and a deep-lying layer of cells. The latter become the endoderm. This type of gastrulation occurs in sponges, various coelenterates, and some of the lower worms. (c) *Ingression*. At one pole of the one-layered germ, cells begin to migrate into the blastula cavity to form the inner layer. This process is found especially in hydroids. The aim of all sorts of gastrulation is the establishment of a two-layered germ containing a digestive cavity. (d) *Formation of mesoderm*. The mesoderm arises in a great number of different ways—sometimes as a pair of pouches or a series of paired pouches from the endoderm, sometimes from primitive "mesoblast" cells which arise very early; sometimes split off from the other germ layers. Indeed, the varied origin of the mesoderm, despite the similarity of the organs to which it gives rise, is one of the strongest bits of evidence of the inadequacy of the cell-layer doctrine.

It will not be practicable to go into the developmental history of all the groups. We will, however, consider in some detail the development of the chick. For the development of man, see EMBRYOLOGY, HUMAN.

**Development of a Dicotyledonous Plant.** The fertilized egg lies deeply embedded in the ovary in a sac—the embryo sac—filled with nu-

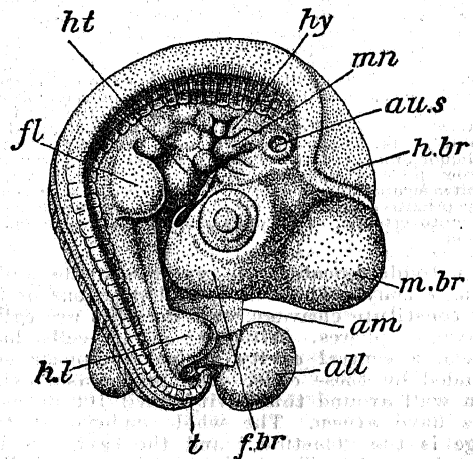


FIG. 16. ADVANCED EMBRYO OF CHICK.

all, allantois; am, cut edge of amnion; aus, auditory sac; f.br, fore-brain; fl, fore-limb; h.br, hind-brain; h.l, hind-limb; hl, heart; hy, hyoid arch; m.br, mid-brain; mn, mandibular arch; t, tail. (After Parker and Haswell.)

tritive fluid. The fertilized egg, or oöspore, develops by means of a series of transverse and longitudinal cleavages into a more or less ovoidal body, the embryo. Certain of the cells of the embryo may early become specialized to form a thread composed of a single row of cells and called the suspensor. By means of the suspensor the embryo is pushed out into the nutritive fluids of the embryo sac. As cell division proceeds, a peripheral layer of cells is differentiated,

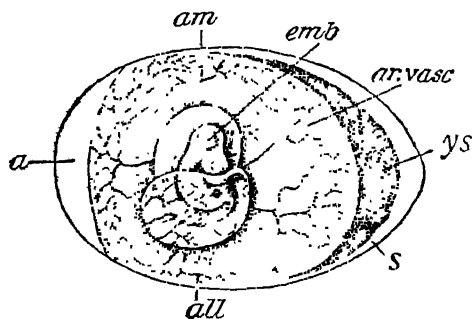


FIG. 17. ADVANCED EMBRYO CHICK.

Condition on fifth day; *s*, shell; *a*, air chamber; *emb*, embryo, lying on the left side, with the head up; *am*, amnion; *all*, allantois, in the cavity between the amniotic layers and performing the chief respiratory function; *ar.vasc*, vascular area (vitelline blood) gradually extending its ramifications over the yolk sac (*ys*) and absorbing its nutriment.

which is the epidermis; also an axial column of cells is often early discernible, with the root-cap cell or cells at the end next to the suspensor, and the stem tip at the opposite end. The cotyledons are early formed by a pair of lateral regions of cell multiplication. In some cases the plumule with its nascent leaves is already formed from the stem tip before germination. The seed may contain the embryo as a minute germ embedded in food material derived from the embryo sac and parts of the ovule (pepper), or the food material may have become absorbed by the embryo and be lodged in the cotyledons (bean).

**Development of a Chick.** The hen's egg, as laid, is a complex thing. The shell and albumen are extraneous substances, laid down around the egg proper, or "yellow of the egg," as it passes along the maternal oviduct. The yellow of the egg is usually, while it is still in the oviduct of the hen, only a single cell, which is immensely distended by food materials or food yolk. The nucleus lies in a thin sheet of protoplasm on top of the yellow. This nucleus divides, but the whole yolk does not, so that partial cleavage occurs, producing a disk of several cells at the time the egg is laid. This disk constitutes the cicatrix, or "scar" or "tread" of the egg, which can be readily seen with the naked eye. It is technically called the germ disk, or blastoderm, and consists of an upper and an under layer. Later a middle layer of cells arises, and the blastoderm is differentiated into a central transparent *area pellucida*, on which the embryo forms, and a peripheral *area opaca*, which is continuous with the central area and extends laterally until it surrounds the entire yolk (Figs. 1-4).

**The Primitive Groove.** Embryonic growth begins by the formation of a long depression in the middle of the germ disk, called "primitive

groove" (Fig. 15), which indicates the region where a modified gastrulation is beginning; also at the hinder edge of this disk a depression is seen, and cells pass forward between the ectoderm and yolk mass, and others are budded off from the yolk to form the endoderm. As the embryo grows longer, the posterior gastrula depression retreats backward and the median depression elongates. Almost simultaneously, from the region of the primitive groove, the mesoderm is produced to the right and to the left. A little later a rod of cells is cut off below the primitive groove, making the notochord, around which the vertebral column will later arise. At about 18 hours a pair of folds rise up at the right and left of the primitive groove. These are the medullary folds, and the depression between them constitutes the medullary furrow. The folds grow higher and arch over towards each other until a complete tube—the medullary or neural tube—is formed. This gives rise to the brain and spinal cord. By the middle of the second day of incubation the head of the chick is marked off by the enlarging brain, the trunk is completed at the tail end, and the mesoderm is seen to be composed of a series of paired blocks of tissue; these correspond to the metameric segments of the body and are called primitive somites. From them the muscles of the body wall will arise. Laterally the mesoderm exists as two thin plates or layers, one of which—the somatic layer—lies close to the ectoderm, and the other—the visceral or splanchnic layer—lies next the forming food canal. Between these layers lies the body cavity.

The embryo is now well outlined. The food canal has a roof, but its floor is a mass of yolk which the ectoderm has gradually enveloped below as well as above. The embryo is gradually raised up above the great mass of the yolk, which now appears as a sac pendent from the underside of the nascent intestine. The head rapidly enlarges; mouth and eyes appear; mesenchymatous cells are laid down around the notochord and form the bones of the vertebral column; the spinal nerves grow forth from the walls of the neural tube; kidney organs, heart, blood vessels, and appendages of the food tube arise in rapid succession (Figs. 5-14, 16, 17).

**Amnion and Allantois.** In the chick, as in reptiles and mammals, two special embryonic organs, in addition to the yolk sac, make their appearance early in development. These are the amnion and the allantois (qq.v.). The amnion is an envelope formed about the embryo, which begins as a fold of ectoderm and somatic layer that completely surrounds the embryo. This fold becomes more and more elevated and finally, as a wall encircling the embryo, folds over the embryo, making a dome whose zenith aperture constantly diminishes until it disappears. The space between the embryo and the amnion is filled with the "amniotic fluid." The allantois is an outpocketing from the hinder part of the food canal which, growing through the still wide-open body cavity, spreads out against the egg membrane. It serves as a respiratory organ, since blood vessels ramify throughout it in great profusion. These get the oxygen which is admitted through the pores of the eggshell and carry it back to the embryo.

As mammals, birds, and reptiles possess an amnion in their embryonic condition, these three classes have been united into a group called Amniota; while the term Anamnia is applied

to the remaining vertebrates (amphibians and fishes) not so provided—the Sauropsida of Huxley.

**The Causes of Development.** These are difficult to discover. In the eighteenth century the idea prevailed that development consisted merely in the unfolding or growing larger of a minute individual, preformed in the egg or sperm cell; likewise it was assumed that a new generation lay in the ovary of that little being, with still smaller individuals inclosed within their bodies, ad infinitum. This is called the box-within-box theory. But exact study of the egg and the processes of embryological development shows that such a miniature does not exist in the egg, and that development is not merely becoming larger. What is it that directs the course of development and determines at what point new organs shall arise? We do not at present know. It is generally believed that the course of development depends somehow upon the chemical constitution of nucleus and cytoplasm. As a piece of a hydra warps itself into an embryonic form and thereafter develops as the egg embryo develops, we must conclude that it is not so much the constitution of the egg or the sequence of cell divisions that determines the form as some internal "force" which acts throughout the entire organism. See EPIGENESIS; EVOLUTION (especially remarks under *Coöperative Evidences of Evolution*); FŒTUS; GERMULE; GERM PLASM; ONTOGENY; PREFORMATION; RECAPITULATION THEORY; VESTIGIAL STRUCTURES; ETC.

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**EMBRYOLOGY, HUMAN.** Our knowledge of the development of the human embryo was in an exceedingly fragmentary condition until Wilhelm His, the distinguished German anatomist, published in 1885 his *Anatomie menschlicher Embryonen*. This was the first, and is yet the most important, work on human embryology. Previously there existed, here and there, isolated descriptions of the first two months of pregnancy. The difficulty in getting embryos renders progress comparatively slow. The number of good collections of human embryos is very small, the most important being those at Leipzig and Baltimore.

In development it is convenient to distinguish the three stages suggested by His, viz., the ovum, the embryo, and the fetus. The stage of the ovum embraces the first two weeks; the embryonal stage embraces the third, fourth, and fifth weeks, during which time the principal organs are developed; finally, in the fetal stage the embryonal features change to those of the

fœtus and full-term child. The average length of embryo and fetus at various stages is approximately shown by the following table:

AGE	LENGTH	
	In inches	In millimeters
2 weeks .....	0.1	2
3 " .....	0.2	5
4 " .....	0.3	8
5 " .....	0.4 to 0.5	11 to 12
6 " .....	0.6	16
7 " .....	0.8	20
8 " .....	1.0	25
3 months .....	2.0	50
4 " .....	3.9	100
5 " .....	7.9	200
6 " .....	11.8	300
7 " .....	14.6	370
8 " .....	18.7	425
9 " .....	19.7	500

**Ovum Stage.** There are no observations on normal ova of the first 9 or 10 days. It is evident from the material of the later part of the ovum stage that there is an early and precocious development of the chorion and villi.

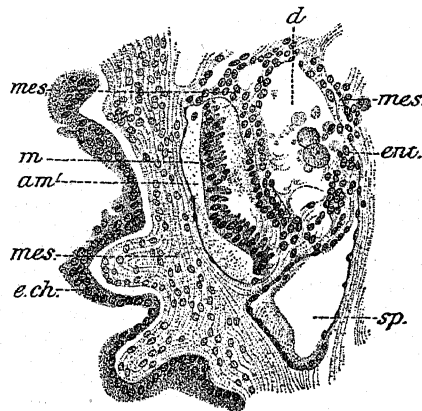


FIG. 1. SECTION THROUGH OVUM.

Section through a portion of a human ovum, with an embryo 1.9 mm. long: *am'* amniotic cavity; *d*, yolk sac; *m*, epithelial plate; *ch.* epithelium of chorion; *mes.* mesenchyma; *ent.* entoderm; *sp.* cleft in exocoelom. (After Peters.)

The youngest-known normal ovum was described by Peters in 1899. It is 10 to 11 days old and consists of a vesicle  $3 \times 1.5 \times 1.5$  millimeters in size (Fig. 1). The vesicle is formed by the chorionic membrane, consisting of an outer layer of epithelial cells covered by numerous villi which are in contact with the uterine wall of the mother, and an inner layer of mesenchyma. Attached to this inner layer at one side is the small embryo but .19 millimeter in length. It is apparently simple in structure, consisting of an epithelial plate facing the small amniotic cavity. On the other side of the plate is a layer of mesenchyma, and projecting from this is the yolk sac lined by entodermal cells. The projecting embryo is surrounded by mesenchyma continuous with that lining the chorion. The epithelial plate of the embryo and the epithelium of the amnion were probably at an earlier stage continuous with the epithelium of the chorion and subsequently cut off by sinking down into the vesicular cavity. Already, then, in the youngest-known ovum the so-called three

primary germ layers are present. (See EMBRYOLOGY.) From the epithelial layer develop the epidermis of the skin and its appendages (hairs, nails, sweat glands, etc.), the central nervous system, and portions of the eye and ear,

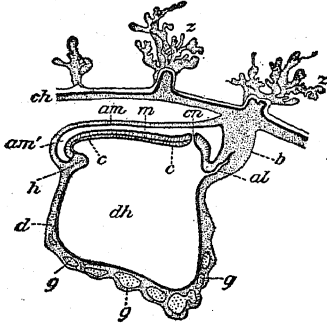


FIG. 2. BEGINNING OF EMBRYO.

Median section of a model of an embryo, 1.54 mm. long: *am*, amnion; *am'*, amniotic cavity; *al*, allantois; *b*, pedicle; *c*, chorda dorsalis; *ch*, chorion; *cn*, neurenteric canal; *d*, yolk sac; *dh*, its cavity; *g*, *g*, blood islands; *h*, place where heart will develop. (After Spee.)

mouth and nose. From the middle or mesenchymal layer develop the skeletal, muscular, circulatory, and urogenital systems; and lastly, from the inner or entodermal layer, here represented by the lining of the yolk sac, develop the alimentary tract, trachea, and lungs, liver and pancreas, and bladder.

The next important human ovum described contained an embryo .37 millimeter in length, and about 11 days old, attached at one side by a broad pedicle. Along the centre of the epithelial plate is a slight groove, the first trace of the central canal of the central nervous system; and a small diverticulum of the sac (the allantois) projects into the pedicle (Fig. 2). A day later the circulatory system has begun to develop, as a simple tubular heart lying in the mesenchyme between the head end of the embryo and the yolk sac. From the head end of the heart is given off the aorta, which divides im-

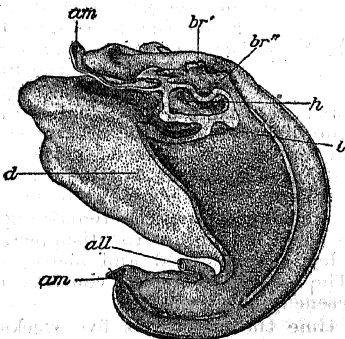


FIG. 3. AN EARLY EMBRYO.

Lateral view of the model of embryo of 2.1 mm. long: *am*, amnion; *al*, allantois; *br*, *br'*, first and second gill pockets; *l*, liver rudiment; *h*, heart; *d*, yolk sac. (After Mall.)

mediately into three pairs of arches that pass around the primitive fore-gut to unite beneath the medullary plate into the dorsal aorta. Blood vessels extend between the embryo and chorion. The yolk sac has now become somewhat constricted along its attachment to the embryo,

leaving pockets of the entoderm under the head and tail ends of the epithelial plate, which form the primitive fore-gut and hind-gut. The medullary folds, which are the first rudiments of the central nervous system, are now well marked, as also is the groove lying between them. Just beneath the epithelial plate, and lateral to the medullary folds, the mesenchyma is divided into 13 pairs of segments, the first differentiation for the muscular system.

At the age of two weeks many important changes have taken place. The embryo has greatly increased in length and is curved into a semicircular form (Fig. 3). The medullary plate is converted into a thick-walled tube, and the groove into its canal. At the anterior end of this tube are enlargements marking the beginnings of the brain, while the remainder of the tube forms the spinal cord. From the fore-gut has arisen the pharynx with two gill pockets and a thyroid pocket, but the main portion of the alimentary tract is still embodied in the large yolk sac. The forebrain of an embryo about 14 days old has a marked ventral bend, and between the forebrain and the heart is an invagination of the skin to form the mouth cavity, not yet connected with the pharynx. Projecting from the forebrain are the optic vesicles, and farther back are invaginations of the ectoderm for the internal ear. Two gill clefts and three branchial arches are present; branches of the aorta pass through the latter.

**Embryonal Stage.** With the formation of the medullary tube and its cephalic enlargements begins the embryonal stage. During the third week the embryo grows rapidly in size and attains a length of about 4 millimeters. The brain increases in size and shows the three primary divisions. The optic and otic vesicles become more prominent. Two more gill clefts and three more gill arches appear, caudal to the ones already formed. The attached area of the yolk sac has diminished. The mouth cavity communicates with the pharynx. By the twenty-first day the limb buds appear. Internally the heart is enlarged and takes the form of an S-shaped tube. From the aorta now arise five pairs of arteries which pass through the five pairs of gill arches joining on the dorsal side of the pharynx into a common dorsal aorta. By the narrowing of the attachment of the yolk sac more of the primitive gut has been folded off, so that now the fore-gut, mid-gut, and hind-gut are to be distinguished. In the fore-gut can already be made out the pharynx with its diverticula, the esophagus and the stomach. Of the pharyngeal diverticula, there are four pairs of gill pockets, corresponding to the gill clefts on the external surface and separated from the gill clefts by a membrane. From the pharynx has also started the diverticulum for the respiratory tube and lungs. The mid-gut forms the small intestine and portion of the large intestine, and from it have arisen diverticula which give rise to the liver and pancreas. The hind-gut gives rise to the rest of the large intestine and the rectum. By enlargement and growth of the amnion around the embryo until it joins the pedicle has been formed the body cavity. From this later are separated the pleural, pericardial, and peritoneal cavities. The primitive urogenital system has appeared as a ridge along the dorsal wall of the body cavity at either side of the median line in the posterior half of the embryo. This ridge con-

tains the Wolffian duct and tubules and the rudiment of the Müllerian duct. There is no sex differentiation.

**Fourth Week.** During the fourth week growth is relatively more active than at any other time. The embryo about doubles in length. During the first part of the week the embryo becomes very much flexed, so much so that the head and tail nearly touch. The brain vesicles

Muscle fibres are beginning to differentiate from the cells of these segments, and their ventral ends grow into the primitive abdominal wall formed by the growing around of the amnion. Condensed mesenchyma marks portions of the vertebral column. In the arm bud the mesenchyma is beginning to differentiate into skeletal and premuscle tissue. The Wolffian ridge has increased in size, and the Müllerian duct is now

formed and runs parallel with the Wolffian duct. A diverticulum from the lower end of the Wolffian duct indicates the beginning of the permanent kidney and its duct. On the Wolffian ridge are also seen the first traces of the sexual glands, but not until the fifth week can sex be determined, even by microscopical examinations.

**Fifth and Later Weeks.** By the middle of the fifth week the embryo is 9 millimeters in length. The amniotic sac is now so much enlarged that it is everywhere in contact with the chorion. A true umbilical cord of some length has developed from the abdominal pedicle attaching the embryo to the chorion as did the pedicle. The head is as large as the rest of the body, due to the rapid growth of the brain. The three primary divisions of the brain are more marked and bent upon each other, and the cerebral hemispheres have begun to grow. The spinal cord is a thick-walled tube. The various cranial and spinal nerves now extend some distance into the body, and the motor nerves reach the premuscle masses of the head and shoulder. The gill clefts and arches are undergoing marked changes. From the first arch the upper and lower jaws are developing. From the first cleft the external auditory canal

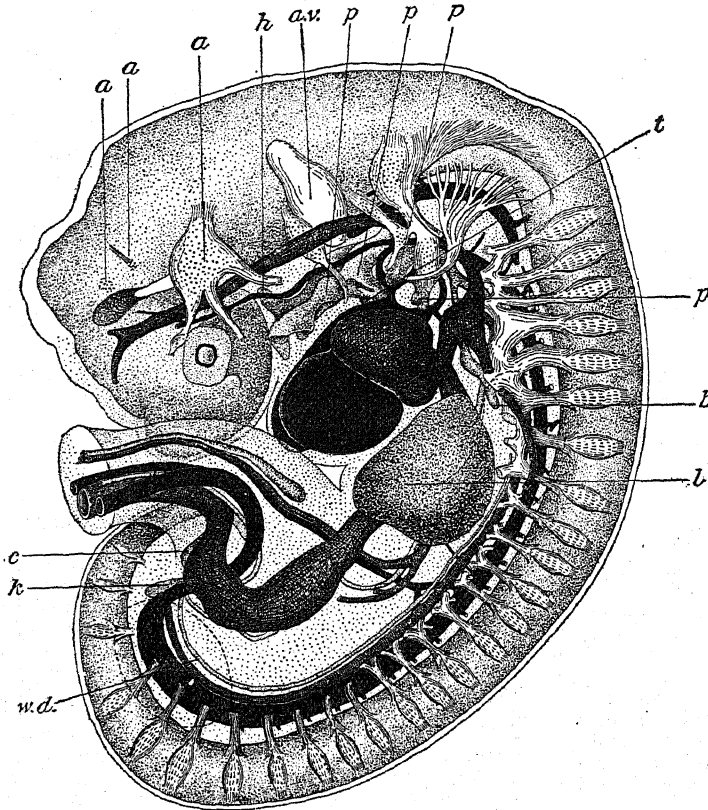


FIG. 4. EMBRYO ONE MONTH OLD.

*a, a, a*, cranial nerves; *a.v.*, auditory vesicle; *b*, bronchus; *c*, cloaca; *h*, hypophysis; *k*, kidney; *l*, liver; *p, p, p*, branchial pockets; *t*, thyroid gland; *w.d.*, Wolffian duct. (After Mall.)

are better developed, as also are the gill clefts and arches, the eyes, ears, and nasal pits. The S-shaped tubular heart with its single cavity is rapidly changing into a complicated four-chambered structure with imperfect partitions. By the end of the fourth week (Fig. 4) the anterior enlarged portion of the head has become bent at right angles to the main axis of the body. From the first gill arch a maxillary process is developing which will ultimately form a portion of the upper jaw; the main portion of the arch will form the lower jaw. The limb buds have increased in size. The arm bud projects from the cervical region, and the leg bud from the lumbar region. The yolk sac is very small, and the amniotic sac is much enlarged. Internally the nerves have begun to grow from the medullary tube or central nervous system into the mesenchyma. Plexuses are forming, but the nerves are not attached to their end organs. There are now 38 primitive segments formed from the mesenchyma lateral to the spinal axis.

and eardrum are forming, and from the pharyngeal portion of the cleft the Eustachian tube and middle ear; while the small bones of the ear arise from the dorsal portion of the first gill arch. From the second arch is forming the hyoid apparatus, and the remaining arches and clefts are beginning to disappear. The arm and leg are enlarged and show two segments. The skeletal system consists of condensed mesenchymal tissue.

By the time the embryo is five weeks old it has attained a length of 11 millimeters. The head is still very large and bent at right angles to the main axis of the body, and the features of the face are forming. The general body musculature is well advanced and has most of its nerve supply. The ribs and the muscles of the thorax and abdomen have grown some distance into the thin membrane which in early stages constitutes the ventral body wall. The limbs are much enlarged and contain a skeletal core of cartilage surrounded by the developing



muscles. Only the fourth pair of the aortic arches now persists entire. The others are modified in various ways to form the larger arteries connected with the aortic arch. The arm keeps about two weeks in advance of the leg in its internal differentiation. The vertebral column and ribs are formed partially in cartilage. The liver has been increasing rapidly in size, and in this embryo, as in the preceding stage, it forms with the heart most of the large projecting abdomen and thorax. The allantois forms a long narrow tube extending from the hind-gut into the umbilical cord as far as the chorion; at a later stage the umbilical portion becomes obliterated, while the portion near the hind-gut enlarges into the bladder.

In an embryo seven weeks old and 20 millimeters long the early fetal features are fairly well marked. The head has now become nearly erect. The fusion of the maxillary and nasal processes is proceeding rapidly to form the upper jaw, and the nasal pits have approached nearer to the median line. The arms and legs are much elongated, show the three segments seen in adults, and fingers and toes are to be distinguished. Every muscle of the body can now be recognized and has also its nerve supply. Most of the skeletal elements are present in cartilage, but portions of the skull are never so represented. The ribs have extended nearly to the mid-ventral line, and the thoracic and abdominal muscles have pushed farther out. By the end of the second month the permanent kidney is fairly well formed, and the Wolffian body, which so far in the life of the embryo has performed the function of an excretory organ, begins to lose its importance. All but the middle portion, which later forms the sexual gland, atrophies. Its duct in the male forms the vas deferens, in the female degenerates; while in the female the Müllerian ducts form the Fallopian tubes and uterus, and in the male degenerate.

By the end of the second month, therefore, most of the organs found in the adult are formed, and the main processes henceforth until birth are the growth and fitting about of these organs. The external features of the human form, although the head unduly preponderates. The limbs acquire definite shape, and imperfect nails are present. The external sexual organs become differentiated into male or female. During the fourth month short hairs without pigment appear on the scalp and parts of the body. The eyelids, nostrils, and lips are closed. The anus opens, and the coils of intestines which were in the umbilical cord now lie entirely within the abdominal cavity. The head forms one-fourth of the body. Ossification of many of the bones is well under way. From this time the embryo is called a "fœtus," and its development and characteristics are described under FŒTUS.

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*Anatomie und Physiologie* (ib., 1896); Eternod, "Premiers études de la circulation sanguine dans l'œuf et l'embryon humains," in *Anatomischer Anzeiger* (Jena, 1899); Kollmann, *Lehrbuch der Entwicklungsgeschichte des Menschen* (ib., 1898); Minot, *Human Embryology* (New York, 1892); Piersol, "Embryology," in *An American Text-Book of Obstetrics* (Philadelphia, 1895); Williams, *Obstetrics* (New York, 1912); McMurrich, *Human Anatomy, Including Structure and Development* (Philadelphia, 1911); Young, *Embryology in the Human Female* (London, 1911); Keith, *Human Embryology and Morphology* (ib., 1913); Meyer and Schwalbe, *Studien zur Pathologie der Entwicklung* (Jena, 1913).

**EMBRYOLOGY IN PLANTS.** The study that deals with the earliest stages of plants. In general the embryo arises from the germination of a spore. In ordinary usage, however, the term "embryo" has been applied to the young plant which is developed within the seed. This embryo is the result of the germination of a fertilized egg, and it is definitely limited by the fact that it passes into a period of rest protected by the seed coats. In the first development of embryology it was thought to be necessary to describe in detail each cell division, especially its plane, from the original segmentation of the egg to the appearance of the growing points of the different regions of the body. Under these circumstances embryology became a very rigid subject, with its categories of "types" and their modifications. Now it is recognized that the development of an embryo varies in response to varying conditions, that there is no rigid sequence in cell divisions, and that the usual uniformity observed is an evidence of uniform conditions rather than of rigid morphological sequence. The present study of embryology is giving scant attention to the sequence of cell divisions, but is concerned chiefly with the organization of the body regions. In other words, it begins where the older embryology stops. This newer phase of the subject, however, is not organized as yet for general presentation. The development of the embryos of various groups of plants given in the following paragraphs, therefore, will be understood as representing the usual early development, which may vary at any stage.

**In Mosses.** In mosses the fertilized egg rests in the female organ (archegonium), which is at the apex of a leafy stem. This fertilized egg begins to germinate at once, and its first wall, resulting in a two-celled embryo, is at right angles to the long axis of the archegonium. The two cells thus formed proceed upon different lines of development: the lower one produces a descending structure called the "foot," which penetrates into the tissue of the leafy stem and anchors the embryo; the upper cell produces the shoot, which is differentiated into stalk and capsule. In this case, therefore, there is no strict point at which the structure may be regarded as ceasing to be an embryo, the whole development being continuous.

**In Ferns.** Among the ferns the archegonium in which the fertilized egg occurs is situated upon the underside of the small prostrate sexual plant (prothallium). In ordinary cases the fern embryo is formed in a somewhat different manner from that described for the mosses. The first wall of the egg, resulting in a two-celled embryo, is parallel with the long axis of the

archegonium, the two cells thus formed facing the apex and base of the prothallium. Each of these cells immediately divides, resulting in the so-called "quadrant stage" of the embryo. Each of these quadrant cells is destined to develop a definite body region. The two cells which face the apex of the prothallium develop the stem and leaf structures; those which face the base of the prothallium develop the root and foot structures. The first wall of the fertilized egg, therefore, has had the same general result as the first wall of the egg in the case of mosses; i.e., it has resulted in separating what may be called the root and the shoot structures. In the ferns the development of the young plantlet is continuous, so that the embryo is limited by no special point in time or structure.

In **Spermatophytes**. Among the seed plants the conditions are quite different. The fertilized egg which lies within the embryo sac of the ovule proceeds to germinate at once and to form an embryo of a variable degree of advancement, and then the whole process is checked by the final hardening of the seed coats. On account of this the embryo lies dormant for an indefinite period, and when the seed is said to germinate the embryo renews its activity and escapes. In this way it is convenient definitely to mark the embryo as the plantlet that is developed within the seed. As might be expected, such embryos differ very much in the amount of their development. Some pass into the dormant stage at a very early period in their history, so that they are hardly more than a small indefinite group of cells; others develop several distinct organs and resemble a well-defined plantlet before passing into the dormant stage. Among seed plants, while there is considerable variation in the details of germination, the general sequence is as follows: The fertilized egg develops a transverse wall, and successive transverse divisions result in a linear row of cells, the cell at one end of the row being anchored to the wall of the embryo sac. The cell at the free or deeper end of the row is the one which either exclusively or chiefly enters into the formation of the embryo, the rest of the row forming the so-called "suspensor" (q.v.), which is an organ of the embryo that serves to connect it with the food supply. In any event, this development of the suspensor results in placing the cell which is to develop the embryo more in the centre of the sac, and hence in a position to be better embedded in the nutritive tissue.

The monocotyledons and dicotyledons are fundamentally different in the organization of their embryos. In both groups the root tip is organized at that end of the axis which points towards the micropyle (the opening left by the integument), and for this reason it is the root tip that first emerges from the seed. In the case of the monocotyledons the end of the axis remote from the root tip organizes the single massive seed leaf (cotyledon), while the stem tip arises laterally, just behind the cotyledon. Naturally in such an embryo there can be but a single cotyledon, and this fact has given name to the group. In the dicotyledons this remote end forms the stem tip, while the cotyledons appear as lateral members just behind the stem tip. This prevailing result in two cotyledons, which has suggested the name of the group; but it does not preclude the development of a single cotyledon, or of more than two. For example, his type of embryo belongs to the conifers,

where in many cases the cotyledons form a rosette of several members. The regions of the complete dicotyledonous embryo, which are more easily defined than those of the monocotyledonous embryo, are as follows: The axis beneath the two cotyledons, at the tip of which is the embryonic root structure, has been named the "hypocotyl." This has been variously called "caulicle" and "radicle," one name expressing the idea that it is a little stem and the other that it is a little root. It is, however, so peculiar in its structure and powers that it can hardly be called either a distinct stem or a distinct root, so that it has received a name of its own and may be regarded as an organ of the embryo. At the summit of the hypocotyl the two cotyledons occur, variously arranged with reference to each other and to the hypocotyl in the seed. Between the cotyledons, as if continuing the axis, there is often a minute bud called the "plumule," which, after the escape of the embryo, develops the shoot. For an account of the escape of the embryo, see **SEED**.

**EMBRYOTOMY** (from Gk. *ἐμβρυον*, *embryon*, embryo + *τομή*, *tomē*, cut, from *τέμνειν*, *temnein*, to cut). A division of the fetus into fragments, to extract it piecemeal, when the narrowness of the pelvis of the mother, or some other faulty conformation, opposes delivery.

**EMBURY, PHILIP** (1729-75). The first Methodist minister in America. He was born of German parents at Ballygaran, Ireland, Sept. 21, 1729. He emigrated to America in 1760. In 1766 he organized a "class" in New York and began preaching, at first in his own house on Barrack Street, now Park Place, and in 1767 in the rigging loft on what is now William Street, which has become famous as the cradle of Methodism in the United States. A chapel was built in 1768 on the site of the old John Street Church, partly by Embury's own hands. In 1769 preachers sent out by Wesley arrived in New York, and Embury went to Camden, N. Y., where he worked at his trade of carpentry and preached on Sundays, organizing a church at Ashgrove. This church is still in existence as St. Luke's Methodist Episcopal Church, Albany. He died from an accident, August, 1775. Consult J. Atkinson, *The Beginnings of the Wesleyan Movement in America* (New York, 1896), and Buckley, *History of Methodism*, vol. i (ib., 1898).

**EMDEN**, *эм'ден*. A city in the Prussian Province of Hanover, situated on an inlet of the Dollart Bay at the mouth of the Ems-Jade Canal and about 75 miles west-northwest of Bremen (Map: Prussia, B 2). It lies low, and its dikes and low-gabled houses give it a quaint Dutch air. It is well built, has spacious and well-paved streets, and is intersected by numerous canals, which are crossed by many bridges. The principal building, and one of the finest public edifices in the whole region, is the sixteenth-century town hall, which contains a library and a curious collection of ancient arms and armor. A large Protestant church, dating from the twelfth century, contains a number of fine monuments. Other interesting buildings are the museum of natural history, the art gallery, the library, and the old barracks. It has schools for the teaching of trade, industry, navigation, and telegraphy; also a deaf and dumb institute. Emden is a cable centre of lines from Great Britain, Spain, and North America. The chief industry is shipbuilding, but there are also ex-

tensive manufactures of machinery, dairying instruments, cable, rope, cement, pasteboard, paper, wire, tobacco, soap, mustard, and basketware. The herring fishery is also important. Emden is connected with Wilhelmshaven by the Ems-Jade Canal. Pop., 1900, 16,453; 1910, 24,038. Emden was known as early as the tenth century. In 1433 it came under the dominion of Hamburg. In 1595 it was raised to the rank of a free Imperial city, and its commerce at that time was extensive. It was made a free port in 1751, was occupied by Holland in 1806, and with the whole of East Friesland was incorporated with the Kingdom of Hanover in 1815 and in 1866 was united to Prussia.

**EMELÉ**, á-má-lá', WILHELM (1830-1905). A German battle painter. He was born at Buchen, Baden, and, after studying in Munich under Dietz, in Antwerp, and in Paris, he settled in Vienna (1861), where he attained great popularity as a painter of equestrian portraits and hunting scenes. His "Battle at the Neckar Bridge in Heidelberg" was bought by the Austrian Emperor, and his "Cavalry Encounter near . . ." gained the first medal at the . . . in 1873. Afterward he resided successively in Munich, Berlin, and Karlsruhe. Among his other works are "Attack of French Cuirassiers at Waterloo" (1867) and the "Battle of Nuits, December 18, 1870," in the Karlsruhe Gallery. His paintings show exact knowledge of military detail and are spirited in conception and good in color.

**EMERALD** (OE. *emeraud*, OF. *esmeraude*, Fr. *émeraude*, Sp. Portug. *esmeralda*, It. *smeraldo*, Lat. *smaragdus*, from Gk. *σμάραγδος*, *smaragdōs*, *μάραγδος*, *maragdōs*, emerald, Skt. *marakata*, emerald). A green-gem variety of the mineral beryl. It was known to the ancients, who valued it for its supposed occult properties and its marvelous power of healing all diseases of the eye as well as for its beauty. Pliny tells of a life-size figure of a lion in Cyprus with large emerald eyes that were so brilliant when the sun shone upon them that fish were frightened away by them. The Emperor Nero had an eyeglass of emerald through which he viewed the sports of the arena. Cortés brought from Peru five emeralds of remarkable beauty and curious design, which are described as marvels of the lapidary's skill—one having been cut into a rose, another a horn, a third a fish with golden eyes, a fourth a bell with a pearl for a clapper, and a fifth a tiny cup. The emerald ring taken from the tomb of Charlemagne, which was used by him as a talisman, was worn by Napoleon on the battlefields of Austerlitz and Wagram and was given by him afterward to Queen Hortense.

In composition the emerald is essentially a glucinum-aluminum silicate, with small quantities of the oxides of calcium, iron, and chromium, the brilliant green color of the gem being attributed to the last-named constituent, though according to some authors it is due to traces of organic matter. The hardness of the emerald is 7.5 to 8, and its specific gravity is 2.5 to 2.7. Originally emeralds came from the Orient and especially from Upper Egypt, where mines are again worked. They are also found near Tokovaya in Siberia, where very large specimens have been obtained. Many of the gem varieties are from the mines of Muso in the United States of Colombia, and from Emmaville, New South Wales. In the United States emeralds have been found in Alexander and Mitchell counties,

N. C. Flawless specimens of emerald are exceedingly rare and command a price almost equal to that of the diamond, and the expression "an emerald without a flaw" signifies unattainable perfection. *Brazilian emerald* is a green variety of tourmaline. *Lithia emerald* is the emerald-green spodumene, or hiddenite (q.v.). *Oriental emerald* is the green variety of sapphire, or corundum. *Uralian emerald* is the green variety of andradite, or demantoid. See GEMS.

**EMERALD COPPER.** See DIOPTASE.

**EMERALD ISLE.** A figurative name given to Ireland (q.v.) on account of the richness of its verdure. It was first used by Dr. Drennan (1754-1820) in his poem entitled "Erin."

**EMERALD WEDDING.** See WEDDING ANNIVERSARIES.

**EMERGENCE** (from Lat. *emergere*, to emerge, from *e*, out + *mergere*, to plunge). A plant outgrowth, technically distinguished from a trichome or hair by the fact that it involves the cortex as well as the epidermis. It is not always easy to detect the differences between a trichome and an emergence, so that in ordinary usage the two are continually confused. In fact, no hard and fast line can be drawn between the two. In general, an emergence may be regarded as a structure of lower morphological value than the stem or leaf or root upon which it may be borne, and of higher morphological value than the trichome or hair which arises only from the epidermal tissue. Emergences include not merely such outgrowths as appear to have no definite function, as in the warts, prickles, etc., but they are sometimes pieces of a definite physiological apparatus. For example, the remarkable tentacles of *Drosera*, which are often called glandular hairs, are emergences; the ligules of leaves of grasses, *Sclaginella*, and *Isoetes* are emergences; as are also the cupules of certain liverworts, as *Marchantia*. Perhaps also the suckers or haustoria of such parasitic plants as dodder, mistletoe, etc., are to be regarded as emergences.

The use of such terms as emergence and trichome, as representing rigid morphological categories, has disappeared. Whether a given structure is an emergence or a trichome is of no significance. The significance of any structure is its function, so that structures are grouped now on the basis of their work, without reference to the origin of the cells that enter into them. See the titles of the various structures referred to; also TRICHOME.

**EMERITUS** (Lat., having served one's time of service). A term which designates certain officials, generally collegiate or pastoral, who have retired from active service by reason of age or illness and retain an honorary position and title corresponding to that held when in active service, as "professor emeritus," "pastor emeritus."

**EMER'SION** (from Lat. *emergere*, to emerge). The reappearance of one heavenly body from behind another, after an eclipse or occultation. The immersions and emersions of Jupiter's satellites are particularly useful for finding the longitude of places, when it is impossible to carry out more accurate determinations with the aid of the electric telegraph.

**EM'ERSON.** A frontier town and the capital of Provencher Co., Manitoba, Canada, 60 miles south of Winnipeg (Map: Manitoba, F 4), on the Canadian-Northern and the Canadian

Pacific railroads, and on the right bank of the Red River. The industries include a cement-block plant, dairying and ranching, and lumbering. The United States is represented by a consular agent. Pop., 1901, 840; 1911, 1043.

**EMERSON, ALFRED** (1859- ). An American archaeologist, appointed associate professor of classical archaeology at Cornell University in 1891. He was born at Greencastle, Pa., and was educated in Germany and at the Johns Hopkins University. Professor Emerson's publications include *Dissertatio de Hercule Homericco* (1881). From 1891 he was for some years a contributing editor of the *American Journal of Archaeology*.

**EMERSON, BENJAMIN KENDALL** (1843- ). An American geologist, born at Nashua, N. H. He graduated in 1865 at Amherst College, where, after further study at Berlin and Göttingen (Ph.D., 1870), he became instructor in geology and professor of mineralogy and geology (1872). For some years after 1878 he occupied in addition the corresponding chair at Smith College. He was assistant geologist in 1890-96, and thereafter geologist, of the United States Geological Survey, for which he prepared a number of valuable geological maps of Massachusetts. He was vice president of the American Association for the Advancement of Science in 1896, vice president of the International Geological Congress at St. Petersburg in 1897, and president of the Geological Society of America in 1899-1900.

**EMERSON, GEORGE BARRELL** (1797-1881). An American educator, born at Kennebunk, Me. He graduated at Harvard, where he was tutor in mathematics and natural philosophy in 1819-21. He was a popular teacher in Boston for many years and served as president of the Boston Society of Natural History and as chairman of the commission for the zoological and botanical survey of the State. He wrote: *Report on the Trees and Shrubs Growing Naturally in the Forests of Massachusetts* (1846; 5th ed., 1894); *A Manual of Agriculture*, with C. L. Flint (1861; rev. ed., 1885); *Reminiscences of an Old Teacher* (1878).

**EMERSON, OLIVER FARRAR** (1860- ). An American philologist, born at Traer, Iowa. In 1882 he graduated from Iowa State College, of whose "Academy" he was principal in 1885-88, and in 1891 he gained the Ph.D. at Cornell University, where, between 1888 and 1896, he was fellow, instructor, and assistant professor of rhetoric and English philology. From 1882 to 1885 he had been superintendent of public schools at Grinnell and Muscatine, Iowa. In 1896 he became professor of English at Western Reserve University. He was president of the American Dialect Society in 1905. He edited *Memoirs of the Life and Writings of Edward Gibbon* (1898), *Johnson's Rasselas* (1905), and *Poems of Chaucer* (1911), and, besides contributing to philological journals, is author of *History of the English Language* (1894); *A Brief History of the English Language* (1896); *Middle English Reader* (1905); *Outline History of the English Language* (1906).

**EMERSON, RALPH WALDO** (1803-82). A famous American poet and essayist, born in Boston, Mass., May 25, 1803. His parents were the Rev. William Emerson and Ruth Haskins, and from them he received the training that the better class of New England parents

bestowed upon their children. His boyhood was passed mainly in Boston. At the age of 20 he was graduated from Harvard College and taught school for a time; then, like a large number of the educated youth of New England at that time, he studied for the ministry. He was ordained March 11, 1829, and became the colleague of Rev. Henry Ware, pastor of the Second Church (Unitarian) of Boston. On September 30 of the same year he married Miss Ellen Louisa Tucker, who died Feb. 8, 1832. Shortly after his association with Ware the latter retired from active service, and Emerson became pastor of the church, one of the foremost in New England. On Sept. 9, 1832, however, he resigned his office, saying, in his farewell sermon, that he had ceased to regard the Lord's Supper as a necessary rite and that he was unwilling longer to administer it. Up to that time he had been known as an able, earnest, and pleasing preacher with tendencies towards radical theology; after one or two attempts to join himself with other parishes, he now entered upon his lifelong career as lecturer and essayist.

In the fall of 1833 he took his first trip to Europe, where he visited Sicily, Italy, France, and England, and met several well-known Englishmen, among them Landor and Carlyle. On Sept. 14, 1835, he married Miss Lidian Jackson. The winters of 1835, 1836, and 1837 were marked by series of lectures, delivered in Boston, on "English Literature," "The Philosophy of History," and "Human Culture." His more elaborated statement of belief, however, is to be found in his first published book, *Nature* (1836), given out anonymously, but soon attributed to him. The volume had a small sale and received almost no popular notice, but it was important as an exposition of the basis of Emerson's philosophy and was accepted by such men as Carlyle as worthy doctrine. Briefly it was a praising of the idealist view of human life, as opposed to the materialist, then common in England and America, and the Calvinist dogma, then still pervasive in New England, and he made the essay a plea for individual freedom. The tendency of criticism to-day is to regard *Nature* as the most poetic and the most original of Emerson's writings, containing in the germ all his later essays and poems. The following year, on August 31, Emerson delivered the Phi Beta Kappa oration at Harvard College on "The American Scholar." This was called by Holmes the "intellectual declaration of independence" for America. Containing, in general, the lofty ethical principles of the author, it is, in particular, a sober and earnest exhortation of his hearers to lead their lives with thoughtfulness, austerity, and self-trust, not leaning for support on the traditions and precepts of the past, but cleaving a way independently in the present. The following year was also notable for proclamations of emancipation. On July 15, 1838, he delivered an address before the students of the Divinity School at Cambridge, expressing his belief in the validity of individual thinking in religious affairs, and on the 24th of the same month he set forth the same general point of view at Dartmouth College, New Hampshire, in a lecture called "Literary Ethics." The first of these incited a warm and widespread controversy, in which Emerson, as usual, took no active part. Throughout his life he never did more than



RALPH WALDO EMERSON





state his views in his own vigorous and winning language, content to let others carry on the discussion which he might have aroused, or body forth in some practical form the impulse which he had given them.

In 1841 the first of his *Essays* appeared. The volume contained several of the papers which have remained of all his work the most popular. It comprised "History," "Self-Reliance," "Compensation," "Spiritual Laws," "Love," "Friendship," "Prudence," "Heroism," "The Over-Soul," "Circles," "Intellect," and "Art." The second series of *Essays* appeared in 1844, containing such titles as "The Poet," "Manners," "Character." In the interval between these two volumes Emerson had done much writing for the *Dial*, the organ of New England idealism, or Transcendentalism as it was called. The paper was started in 1840, with Margaret Fuller as editor. Emerson himself succeeded her and remained editor till the collapse of the enterprise in 1844. With the other and better-known experiment of the Transcendentalists, the Brook Farm (q.v.) Community, Emerson had nothing to do. He had found on inquiry that the soil of Brook Farm was poor, and he disapproved of an adventure so inexpertly undertaken. In 1847 appeared the first volume of Emerson's poems, many of which had been published in the *Dial* during its brief existence. In the same year he wrote the editor's address for the newly founded *Massachusetts Quarterly Review*, but did no further writing for it. In October he set sail for Europe for the second time. He delivered in England a series of lectures, some of which he gathered together in a volume entitled *Representative Men* (1850). The subject suggests Carlyle's *Heroes and Hero-Worship* of 10 years before; but the treatment of the subjects and the manner of approaching them are different. With Carlyle, the hero, be it in war or in letters, is the man who molds the way of the world; with Emerson the representative man is so called simply because he stands for an ideal of individual integrity—a character whence springs his worth. The journey to Europe also resulted in 1856 in a brilliant book of travel, *English Traits*. In 1860 appeared *The Conduct of Life*, the first of his books to enjoy immediate popularity, a volume of essays on such subjects as "Power," "Wealth," "Fate," and "Culture." This was followed in 1867 by a collection of poems, which had previously been published in the *Dial* and the *Atlantic Monthly*, entitled *May Day and Other Pieces*, and in 1870 by another volume of ethical essays, *Society and Solitude*. During the winters of 1868–70 Emerson delivered a series of lectures at Harvard College on the *Natural History of Intellect*, which were posthumously published (1893). He made his third and last voyage to Europe in 1872. From about this time his memory began to show signs of giving way, and, though he retained to the end of his life his command of his general ethical principles, his work after 1875 was fragmentary and scattering. In 1874 he made a collection of favorite poems, which he called *Parnassus*, and the following year his last volume of essays, *Letters and Social Aims*, appeared. A revised edition of his poems followed in 1878, and the same year were published a lecture on the "Sovereignty of Ethics" and one on the "Fortunes of the Republic." His death, which came after

a short illness, occurred at Concord, Mass., April 27, 1882.

Emerson is described as tall and slender. He was nearly 6 feet in height and weighed about 140 pounds. He was not erect in carriage. His head was rather small in dimension, long and narrow, but lofty and symmetrical. "His face," says Holmes, "was thin, his nose somewhat accipitrine, casting a broad shadow; his mouth rather wide, well formed and well closed, carrying a question and an assertion in its finely finished curves; the lower lip a little prominent, the chin shapely and firm. His whole look was irradiated by an ever-active inquiring intelligence. His manner was noble and gracious." His personal habits were of the simplest sort, but were in no wise ascetic. He is said to have been somewhat oppressed by a feeling, not uncommon among New Englanders of the more refined sort, of physical insufficiency; and this trait may account for the fact that he rarely gave himself to active measures, but chose to live the contemplative life.

Emerson takes rank among the foremost writers of his time. All his prose, with the possible exception of one or two chapters in *English Traits* and a few biographical sketches, may be strictly called essays. They represent a point of view of singular unity and persistence, and the chronology is really unimportant. Possibly the addresses printed in the volume called *Nature*, together with that tract, all of which were written before 1845, represent a slightly more enthusiastic and zealous spirit than the later essays and are rather more specific in subject. But, in the main, all the essays set forth a constant and enthusiastic belief in the value of individuality and the need of every man's planting himself in the ground of his own consciousness and natural affection. Being himself a man of many intuitions and of wonderful vigor in them, he is to be regarded as a philosopher rather than as a philosopher. He sought to construct no system, but stood for a constant idealistic impulse.

Emerson's poetry is written from much the same point of view as his prose. While his contemporaries and friends among American poets were expressing themselves variously, as Poe in the search for beauty, or Longfellow in the phrasing of generous truisms and romance, or Whittier in his antislavery verse, or Holmes in his graceful occasional way, Emerson was uttering his feeling for the innate morality of the universe. The number of his poems is not large, for he wrote only when the mood prompted him and not systematically. Few of his poems are long, but one is narrative, and almost all may be termed philosophical and reflective. They are by no means so popular as those of Longfellow or of Whittier; but among them are to be found some of the best poems that America has produced. Among the best known are: "The Sphinx," "The Problem," "Hamatreya," "The Rhodora," "The Humblebee," "The Snow-storm," "Woodnotes," the "Threnody," in commemoration of the death of his young son, the "Concord Hymn," "Brahma," "Voluntaries," "Terminus," and the quatrain "Sacrifice."

Emerson has been the subject of much criticism. That of an adverse sort censures him for relying chiefly or altogether on his intuitive consciousness instead of submitting his generalizations to the test of reason. Though gifted, to a degree very unusual among men, with a

genius for piercing appearances, he seldom or never took . . . say the rationalists, to analyze these vivid impressions with a view to . . . their verity. The consequence is : . . . some of his work is fresh and wholesome in its truth-bearing qualities, much of it is obscure and unsubstantiated in the common experience of mankind. Another criticism somewhat akin to this is directed at his frequent superficiality, born of the same failure to verify statements by patient investigation. In consequence of this trait his work is very uneven, disjointed, and formless. It is an agglomeration of detached sentences and epigrams, rather than a reasonable and consecutive . . . uth. Finally, it is charged . . . on his immediate followers was to cultivate a frequently epigrammatic and obscure manner of uttering platitudes and shallow thought and that in the main he has retarded in America the growth of reasonable thinking processes. On the other hand, even his severest critics would admit that his influence has largely been wholesome. That influence has certainly been vast; no other American man of letters probably has been so potent a source of inspiration to his fellows, nor seems more likely to contribute permanently to European thought. His influence upon Maeterlinck and Bergson in France, and upon Nietzsche in Germany, of itself gives him international importance. Coming at a time when the general tendency in America was towards a belief in material happiness, he taught that a man has also a spring of joy and hope in his inner consciousness. He stimulated men to a better faith in themselves, induced them to rely less on number, masses, and externals. Except in a few specific counsels, as about the reading of books, he rarely uttered a particular dogma, but stood generally for a large and dignified attitude towards life. He was a firm believer in the inner goodness of his country and of his fellow citizens.

Emerson's manner is unfailingly characteristic and original. He uses homely, simple language, racy of the soil of New England, very specific in its wealth of imagery, but never crude. His writing is almost always lively, but never fails to betray the calm and dignified spirit of the writer. It is often disjointed and often uneven, epigrammatic, and choppy, but not infrequently contains a passage of great power and beauty. Many of his sayings, as "Beauty is its own excuse for being," and "A foolish consistency is the hobgoblin of little minds," are household phrases, and of longer passages few anywhere are more forcible than such as that on the use of books, in "The American Scholar," or the closing paragraphs of his "Lecture on the Times." The one-hundredth anniversary of Emerson's birth was celebrated all over the United States and in England.

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**EMERTON, EPHRAIM** (1851- ). An American historian. He was born in Salem, Mass., and studied at Harvard (1871) and Leipzig . . . In 1876 he became a tutor in history at Harvard and in 1882 was elected Winn professor of ecclesiastical history. His principal works on the Middle Ages and the . . . of the Reformation, *An Introduction . . . of the Middle Ages, 375-814* (1888), *Medieval Europe, 814-1300* (1894), and *Desiderius Erasmus*, in "Heroes of the Reformation" (1899), are of great value. With Diesterweg, H. B. Adams, and others he wrote *Methods of Teaching History* (1883).

**EMERTON, JAMES H.** (1847- ). An American naturalist and illustrator, born at Salem, Mass. He illustrated Packard's *Guide to the Study of Insects*, Scudder's *Butterflies in North America*, A. E. Verrill's papers in *Reports of the United States Fish Commission* (1874-84), and C. S. Minot's *Embryology*. He also constructed zoölogical and anatomical models for museums at Cambridge, New Haven, New York, Philadelphia, and Washington. Besides seven papers in the *Transactions of the Connecticut Academy* on "The New England Spiders," he is author of *The Structure and Habits of Spiders* (1878) and *Common Spiders of the United States* (1902).

**EMERY** (formerly *emeril*, from OF. *emeril*, Sp., Portug. *esmeril*, It. *smiriglio*, from Gk. *σμίρις*, *smýris*, *culpis*, *smiris*, *emery*). A variety of corundum (q.v.), or of the same mineral species of which corundum and sapphire (with Oriental ruby, etc.) are also varieties. It agrees with them very perfectly in hardness and specific gravity, but is dull, opaque, and not crystallized, sometimes of a grayish black and sometimes of a blue color. It contains chiefly alumina and oxide of iron, but less of the former than does either corundum or sapphire. Margarite, garnet, spinel, and other minerals may be associ-

ated with the corundum. Emery occurs both massive and disseminated; although very compact, it has a somewhat granular structure. It is found at a number of different localities. In Asia Minor, which is an important commercial source, it occurs as lumps or masses in crystalline limestone, or in the residual clay from the same. Most of the emery used in America comes from Turkey, but in the United States it is known to occur at Chester, Mass., and Peekskill, N. Y., while corundum in deposits of economic value is found in North Carolina and Georgia. The Chester emery forms lenses in a hornblende schist, while the Peekskill material is found as masses in gabbro, an igneous rock, from which it has segregated during the process of cooling and crystallization.

It is prepared for use by first breaking it into pieces about the size of a hen's egg, then crushing these to powder by stamps. It is then sifted to various degrees of fineness, which are numbered according to the meshes of the sieve. Plate-glass manufacturers and others separate emery powder into different degrees of fineness by the method of elutriation. A number of copper cylinders of graduated capacities are placed in a row and filled with water; the emery, churned up with an abundance of water, is admitted by a pipe into the smallest; it then passes to the next in size and finally flows from the largest; and thus, as a given quantity of water with emery suspended in it passes in equal times through vessels of varying capacities, the amount of agitation will obviously be greatest in the smallest vessel, least in the largest, and in like proportion with the intermediate; the largest particles therefore sink in the smallest vessel, and so on till only the very finest will reach the largest vessel. In this manner any number of gradations of fineness may be obtained, according to the number of sizes of the vessels. Elutriation in oil or gum water is sometimes used on a smaller scale, the emery being stirred up in the liquid, and portions poured off at different intervals of time, the finest being of course the last to settle. The use of the oil or gum is to make the subsidence take place more slowly.

Emery thus prepared is used for a great many important purposes in the arts. As it is next in hardness to diamond dust and crystalline corundum, the lapidary uses it for cutting and polishing many kinds of stone. Glass stoppers of all kinds are ground into their fittings with it. Plate glass is ground flat by its means; it is also used in glass cutting and in grinding some kinds of metallic fittings. When employed for the polishing of metals, it has to be spread on some kind of surface to form a sort of fine file. Emery paper, emery cloth, emery sticks, emery cake, and emery stone are various contrivances for such purposes. Emery paper is made by sifting emery over paper which has been covered with a coating of glue. It is used either by wrapping it round a fine file or a stick, or in the hand, according to the form of the work. Emery cloth is made like emery paper, with coarse cloth substituted for the paper. The emery does not adhere so well to this as to paper, and it is therefore not used by metal workers, who work emery paper till smooth with wear, but is chiefly used for purposes where the hand alone is used and paper would tear. Emery sticks are used for the same purposes as emery paper wrapped round files; they are made of

wood sticks shaped like files, then glued over, and dipped once or twice in a heap of emery. Emery stone is a kind of earthenware mixed with emery, formed by pressing a mixture of clay and emery into suitable molds and then firing, like common earthenware. It is molded into wheels, laps, etc. Its hardness and cutting power are very considerable. Emery wheels are most efficient; they vary in diameter from 1 to 36 inches and are revolved at a high velocity. Consult Merrill, *Non-Metallic Minerals* (New York, 1910), and Pratt, *North Carolina Geological Survey*, vol. i (1905). See ABRASIVES.

**EMERY, HENRY CROSBY** (1872- ). An American economist, born at Ellsworth, Me. He graduated from Bowdoin College in 1892 and studied at Harvard (A.M., 1893), Columbia (Ph.D., 1896), and Berlin universities. Between 1894 and 1900 he was instructor and professor of political economy at Bowdoin and from 1900 to 1909 professor of political economy at Yale. In the latter year he became chairman of the United States Tariff Board, but in 1913 he returned to his position at Yale. He is author of "Speculation on the Stock and Produce Exchanges of the United States," in *Columbia University Studies* (1896); *The Tariff Board and its Work* (1910); *The Work of the Tariff Board in Connection with the Cotton Industry* (1911); *Politician, Party, and People* (1913); *Some Economic Aspects of War* (1914).

**EMERY, STEPHEN ALBERT** (1841-91). An American musician. He was born at Paris, Me., and studied at Leipzig, where he had such distinguished teachers as Richter, Hauptmann, and Plaidy. After further tuition under Spindler at Dresden he returned to Portland and was shortly afterward appointed instructor at the New England Conservatory in Boston. Here he remained for three years and upon the establishment of the College of Music of Boston University was made professor of harmony and counterpoint at the same institution. His works comprise pianoforte compositions, songs, string quartets, part songs, and two textbooks respectively on pianoforte playing and on *The Elements of Harmony*. The latter is regarded as a standard work.

**EMERYVILLE.** A city in Alameda Co., Cal., near Oakland, on San Francisco Bay, and on the Atchison, Topeka, and Santa Fe Railroad. It contains extensive stockyards and packing houses, ironworks, railroad yards, oil refineries, fertilizer plants, paint, rubber, and cracker factories, etc. A noteworthy feature is Shell Mound Park, which contains an old Indian mound. Pop., 1900, 1016; 1910, 2613.

**EMESA.** See HOMS.

**EMETIC** (Lat. *emeticius*, Gk. *ἐμετικός*, *emetikos*, emetic, from *ἐμειν*, *emein*, to vomit). Medicine given for the purpose of producing vomiting (q.v.). Emetics are given when it is desired to relieve the stomach of some noxious or indigestible substance, as a poison, or excess of food, or some special article of diet which has disagreed. In some diseases of the respiratory organs emetics are given as a quick and safe method of removing accumulated mucus from the air passages; and in croup (q.v.) their action is especially favorable, being often followed by expectoration and a rapid improvement in the suffocative symptoms. There are two classes of emetics: (1) local irritants to the stomach, as mustard; (2) emetics acting on the vomiting centre in the brain, as ipecacuanha,

apomorphia, and tartar emetic. The former are safer; but ipecacuanha is well borne by children with croup. Emetics are to be given with great caution in all very depressed states of the system, as their primary action is to produce nausea (q.v.), which is attended always with more or less diminution of the vital power and often with great depression of the heart's action, amounting to syncope or fainting.

**EMETIC MUSHROOM.** See FUNGI, EDIBLE AND POISONOUS.

**EMETINE** (from Lat. *emeticus*, emetic),  $C_{30}H_{40}NO_8$ . An alkaloid which forms the active principle of ipecacuanha root. It is a yellowish-white powder, which is slightly soluble in cold water, but dissolves readily in alcohol. When taken internally, it exhibits violent emetic properties. See IPECACUANHA; ALKALOIDS.

**EMEU.** See EMU.

**EMIGRATION** (Lat. *emigratio*, removal from a place, from *emigrare*, to emigrate, from *e*, out + *migrare*, to depart). In the broadest sense emigration denotes the transfer of residence from one place to another. But so broad a definition includes many phenomena, such as the movement from rural districts to the cities or the settling of the West by pioneers from the Atlantic States, which are not commonly designated as emigration. To be an emigrant usually implies that a person leaves his own state and places himself under the jurisdiction of a foreign power, that his destination is widely distant from the mother country, and that he is one of many who are doing the same thing. Immigration is obviously the same thing as emigration, however we define the latter, viewed from the standpoint of the country which receives persons from other lands.

**History.** The movement of tribes and races, some account of which will be found in the article MIGRATIONS, is one of the chief features of history from the earliest times. On the other hand emigration is a comparatively modern phenomenon; it is a movement of individuals rather than tribes and communities, and while it may assume vast proportions, the initiative proceeds from individuals. The history of emigration in this sense really begins with the discovery of America, particularly with the establishment of English colonies on the North American continent. Though the Spanish power was planted in South America and about the Gulf of Mexico much earlier, the Spanish administration was monopolistic in the extreme and did not promote emigration to the New World. As all foreigners were excluded from the Spanish colonies, and no Spaniards permitted to betake themselves thither without special permission of the crown, it will be understood that no considerable stream of immigrants flowed into them. Nor were the French more successful. As they copied in the New World the feudal privileges and inequalities of the Old, the French colonies offered no refuge to the oppressed. In the period of French rule in Canada France indeed poured forth or drove forth some of the best elements of the nation in considerable numbers, but these were Huguenots, to whom Canada was barred.

In marked contrast with these colonies were the English settlements in the New World. Widely scattered, they offered to the Pilgrim in New England, the Quaker in Pennsylvania, and the Catholic in Maryland freedom from the restrictions of the Old World, while most of the colonies offered complete religious freedom to

all comers. It was therefore to the North American continent that the stream of emigration which had its principal sources in England and Germany flowed. During the brief period of Dutch rule on the Hudson there was some influx of Netherlanders, with whom were associated some Huguenot refugees, while the Swedish settlements on the Delaware were too ephemeral to leave many traces behind them in the population of the region. From central, eastern, and southern Europe there was no emigration in the eighteenth century; nor did it assume considerable proportions until the close of the nineteenth century. The numbers of such emigrants were very small compared with those of modern times; precise records do not exist, but it may be recalled that in 1800, after at least a century and a half of occupation, the United States had a population of 5,308,483, and this fact may be contrasted with the immigration record for the 10 years 1881 to 1890 of 5,246,616 persons, or nearly 5 millions in the 5 years 1905-09.

Modern emigration begins in the nineteenth century, though its earlier years showed no marked increase on the shifting population during the preceding century, as is evidenced by the paucity of records. It was not until 1820 that the first statistics on the subject, viz., those of immigration into the United States, were established, while until 1840 only 742,564 arrivals were recorded. In the meantime Australia had been opened up for settlement, but before the gold discoveries (1850) it had not attained a population of half a million souls. The potato famine in Ireland, the economic distress of Europe generally in the period of 1845-50, and the discovery of gold in California and Australia stimulated an emigration far in excess of anything which had previously occurred. While the number fell off somewhat after 1860, it rose again after 1870 until it reached the highest point of the century in the early eighties. Until the close of the nineties it remained almost stationary. In the first decade of the twentieth century the volume of emigration increased steadily from 487,918 in the fiscal year 1901 to 1,285,349 in 1907. In 1908 the volume decreased to 782,870, increasing again to 1,041,570 in 1910. In the fiscal year 1913, 1,197,892 persons emigrated to the United States.

**Difficulty of Measurement.** Precise figures cannot be given, as the records of the ports of departure as well as those of arrival are not always to be had. From a statistical standpoint there are many obstacles to a perfectly accurate record, the chief being that of double counting. Emigrants return to their native land and again emigrate, which causes double counting at the ports of departure; while emigrants pass from one country into another, particularly from Canada to the United States, and this, together with the return of persons who have been in the country before, causes double counting at the points of arrival. These difficulties, which prevent perfectly exact measurements, such as the calculation of an emigration rate for comparison with other phenomena of the population movement, do not impeach the testimony of all available records as to the general growth of emigration. The emigration figures, so far as they are recorded in the European countries, are based upon such diverse elements that careful writers abstain from the attempt to make a total. Almost equally unsatisfactory

for comparative purposes are the records of the countries which receive immigrants. Some notion of the volume of emigration from Europe can be gained from the fact that from 1820 to 1913 the records of the United States show 30,982,114 arrivals. Other regions received comparatively few immigrants until recent years. In 1870 the arrivals in the United States (387,203) far exceeded those of Canada, Brazil, Argentina, Uruguay, and Australia combined, which according to the records of those countries amounted to 108,772 persons, while in 1890 the arrivals in the United States (455,302) were less than those of the five regions above named (546,934). For later years figures are not available, as Canada has discontinued its statistics of immigration; but it may be stated in round numbers that from one million to a million and a half of persons leave Europe annually for foreign lands, about two-thirds of this number coming to the United States.

**Causes.** No attempt to summarize the causes of emigration in a single phrase can be successful. They are as numerous as the motives which determine conduct. At one time it is the spirit of adventure which calls men forth to seek their fortunes in the unknown. This is peculiarly the case with the gold seekers, whether they followed the Spanish arms to the conquest of Mexico and Peru, or flocked to the mines of California and of Australia, or in our own day bear the hardships of an arctic climate in the Klondike and at Nome. Religious oppression has been a powerful element in causing emigration, as illustrated in our own early history, and to-day in the influx of Russian and Rumanian Jews. Crop failures, like the potato famine in Ireland, and industrial depression at home, are potent factors in determining men to emigrate. The hope of economic betterment, the attraction of cheap land, and the prospect of becoming landowners, the solicitation and representations of friends or relatives who have preceded them—in short, an infinite variety of circumstances may have a deciding influence.

**The Loss by Emigration.** While emigration may usually be assumed to imply a loss of population, opinion is by no means unanimous that such a loss is an evil. Increasing population may or may not be a national gain. In certain regions there can be no doubt that increase tends to overpopulation, but this cannot be asserted of Europe generally. It is, however, pointed out that emigrants are, as a rule, grown men in the active years of life. In fact, of the arrivals in the United States in 1910-11, 80.9 per cent were adult males between the ages of 14 and 45, while in the population at large there were in 1910 only 50.8 per cent between the ages of 14 and 45. Emigration means a loss of able-bodied workers. How great is the loss? Various attempts have been made to estimate this. One method, that of the celebrated German statistician Engel, reckons the value of an emigrant by the cost of his education and rearing. Other writers insist that his value should be reckoned by his productive capacity, and claim that either the annual income of a laboring man, or at least the excess of his production over his personal consumption, should be taken as a basis for calculating the capital which such income represents. Results will vary according to circumstances and methods of calculation, but they vary from a capitalized value of \$200 to \$2000 per head; which with an emigration of

100,000 persons would mean an annual loss of \$20,000,000 to \$200,000,000. Considerable as these figures are, they shrink into insignificance when compared with the national wealth of Austria-Hungary, or even of Italy or Russia, the only countries which furnish an annual emigration of 100,000 persons. Moreover, it is not universally conceded that these calculations are right in principle, that men as such have a value to the community which represents a capital sum.

Still, if emigration is regarded as a positive loss, it must, on the other hand, be granted that it has compensation in helping build up new markets for the mother country. Further, returning emigrants are likely to bring with them a considerable amount of capital, and, what is more important, new methods of work and new standards of consumption, that react powerfully upon the economic and social life of their native communities. In short, the conditions which surround emigration are so complex that any general rule of its value or harmfulness to the mother country must be so guarded as to be practically valueless.

**Relation of the Government to Emigration.** The attitude of the state towards emigration has been influenced not so much by economic considerations as by political and sentimental motives. It has ranged from positive encouragement to absolute indifference and positive opposition. The attitude of governments has been greatly influenced by the possession of colonies or by their absence. Whenever the state has had distant colonies, it has sought to direct the stream of emigration to them and has offered particular inducements to intending colonists. Before the establishment of self-government in the Australian colonies Great Britain organized in 1837 a board of colonization commissioners, succeeded in 1840 by the Colonial Land and Emigration Board, whose chief function was to provide emigrants for the colonies by spreading information and by assisting emigrants with passage money. France in like manner provides special encouragement for French settlers in Algeria, and Germany is entering the same path as respects its possessions in Africa. Colonization societies with the support of the government authorities offer another opportunity for the state to show its interest in promoting emigration.

States which have no colonies of their own have either sought to discourage emigration or have remained indifferent to it. In the early days of the last century emigration was an offense against the law in many countries of continental Europe. Such restrictions have long since passed away and were succeeded by complete indifference, emigration becoming a private matter which the state had to tolerate, but in which it took no part. The movement has, however, reached such proportions that most of the European states have passed laws designed to protect intending emigrants and to prevent reckless emigration. Such laws exist in England, in Belgium since 1876, Switzerland since 1888, Italy since 1889, Germany and Austria since 1897. These laws have many features in common. The maritime nations prescribe rules for the transportation of emigrants and establish inspecting officers to carry them out. These rules extend to the fitness of the vessels employed, their seaworthiness, their facilities for caring for emigrants, feeding them, and providing suitable

medical attendance. They also prescribe rules for the sanitary inspection of vessels, the exclusion of persons suffering from contagious diseases, and kindred matters.

A second feature of these laws relates to immigration agents and the contract. In all the agent requires of some government authority for the prosecution of his business and is required to give bonds for his faithful observance of the law. He renders himself liable to fine or imprisonment by any false pretenses. In general these laws prescribe that the contract between the agent and the intending emigrant must be in writing. As an illustration of the scope of such laws, it may be noted that in Germany any contract which contemplates the payment of the passage money after arrival is illegal, and that no contract can be entered into in which a foreign state or society pays any part of the passage money. In Switzerland contracts must be individual, and no agreement to furnish a given number of emigrants is valid.

A third feature of such legislation is the establishment of official bureaus of information for intending emigrants. This is a special feature of the Swiss legislation, such officers to give no advice either for or against emigration, but to furnish the fullest possible authentic information upon any questions concerning foreign countries and transportation thereto which may be put to them. Such offices are intended as a corrective of the naturally glowing accounts furnished by interested agents, who, however strictly prohibited by the law from giving false information, cannot readily resist the temptation to increase their business operations.

Consult: Mayo-Smith, *Emigration and Immigration* (New York, 1890); Philippovich (ed.), *Auswanderung und Auswanderungspolitik in Deutschland* (Leipzig, 1892); *Commisariato dell'emigrazione e colonie*, vols. i-iii (Rome, 1903-08); Josephy, *Die deutsche überseeische Auswanderung seit 1871* (Berlin, 1912); Bouvé, *Treatise on the Laws Governing the Exclusion of Aliens in the United States* (Washington, 1912); Fairchild, *Immigration a World Movement and its American Significance* (New York, 1913); Jenks and Lauck, *The Immigration Problem* (3d ed., ib., 1913); Johnson, *The History of Emigration from the United Kingdom to North America, 1763-1912* (London, 1913). Works which treat the subject from the standpoint of immigration are cited under that head. See COLONY; IMMIGRATION; MIGRATION.

**ÉMIGRÉS**, à'mé'grâ' (Fr., p.p. of *émigrer*, from Lat. *emigrare*, to emigrate). The name given to the Royalists who fled from France during the Revolution of 1789. After the disturbances at Paris and the taking of the Bastille (July 14, 1789), the princes of the royal family departed from France with a numerous following of the French nobility. In the autumn of the same year an even larger number took flight, and the climax was reached in 1791, at the time of the adoption of the new constitution. Nobles, prelates, priests, and monks crossed the frontier into Germany, Holland, and Switzerland, and even penetrated in large numbers as far as Italy. The flight of so many of the nobility brought suspicion on the King and those few who remained, and did more than anything else to make the position of the King as a constitutional monarch untenable. The

*émigrés*, in fact, did incalculable harm to France, not only by leaving their country at a time of grave crisis and danger, but also by plotting with her enemies at a critical moment and thus exasperating the Republicans. A court formed itself round the Bourbon princes at Coblenz; a government, with ministers and a tribunal of justice, was established, and communication was kept up with all the foreign courts unfavorable to the Revolution. Under the command of the Prince of Condé a corps of *émigrés* was formed, which attached itself to the force of the Duke of Brunswick, gathered at Coblenz. The result was that the severest laws were now put in force against the *émigrés*. Their lands were confiscated, and the penalty of death was proclaimed against any one who should support or enter into communication with them; 30,000 of the nobility were placed on the list of *émigrés* and exiled forever from the soil of France. Not until after the failure of their attempt to land at Quiberon in 1795 did they abandon all thoughts of penetrating into France by force of arms. Condé's corps, after the Peace of Lunéville (1801), was obliged formally to disband, and its leader sought an asylum in Russia. Between October, 1792, and the dissolution of the Convention more than 300 laws had been passed against the *émigrés* and their relatives. Their relatives were formed into an ostracized class, deprived of civil rights, obliged to live under police supervision, liable to a number of special fines and taxes. At the beginning of the Revolution the *émigrés* had all been nobles and traitors to France, but by 1795 this was not the case. In 1797 the Directory stated the number of *émigrés* on the lists to be 120,000, half of whom were known to be in France, and, in 1796, 300,000 of their relatives were on the proscribed lists. The reasons for this harsh treatment lay especially in the fact that the confiscated property of the *émigrés* was the security for the assignats and thus the financial basis of the Republic. Vast interests depended upon the exclusion laws. Already under the Directory (q.v.), however, many *émigrés* had endeavored to obtain permission to return to France. The general amnesty proclaimed by Napoleon as First Consul (1799) was therefore joyfully hailed by the greater portion of the *émigrés*. Many, however, did not return until after the downfall of Napoleon. Dignities, pensions, and offices were then showered upon these faithful adherents of the Bourbons; but, according to the Charter of 1814, they were unable to recover either their estates or their privileges. Finally, under the Villèle ministry, those who had lost their land estates received a compensation of 30,000,000 francs yearly, based on a capital of 1,000,000,000 francs. This was by the Law of April 27, 1825. After the July revolution, however, the grant was withdrawn. Consult: Saint-Gervais, *Histoire des émigrés français depuis 1789 jusqu'à 1828* (3 vols., Paris, 1828); Morse-Stephens, *History of the French Revolution* (London, 1891); Daudet, *Histoire de l'émigration Coblenz, 1789-1793* (Paris, 1889); and *Les émigrés et la seconde coalition, 1797-1800* (ib., 1886); Comte T. G. de Lally-Tollendal, *Défense des émigrés français* (ib., 1797); A. Sorel, *L'Europe et la révolution française* (ib., 1903); Forneron, *Histoire générale des émigrés* (3 vols., ib., 1884-90). See FRANCE.

**ÉMILE OU DE L'ÉDUCATION**, à'mèl' ou



de là'du'ká'syôn'. A socialistic and didactic treatise, in the form of a romance, by Jean Jacques Rousseau (1762).

**EMILIA**, â-mē'lyā. A division of north Italy, comprising the provinces of Bologna, Ferrara, Forlì, Modena, Parma, Piacenza, Ravenna, and Reggio nell' Emilia (Map: Italy, C 3). Area, 7993 square miles. Pop., 1901, 2,477,697; 1911, 2,740,316. Prior to its inclusion in the Kingdom of Italy, in 1860, it consisted of the former duchies of Parma and Modena and the papal Romagna. The name is derived from the Via Emilia, a highway which traverses the district and was built by the censor Æmilius Lepidus (186 B.C.) to connect with the Via Flaminia, or great northern road from Rome.

**EMILIA**. The wife of Iago and maid of Desdemona in Shakespeare's *Othello*, who unmasks her husband and is killed by him.

**EMILIA GALOTTI**, â-mē'lyā gá-lôt'té. A tragedy by Lessing, produced in 1772. The plot is taken from the Roman story of Virginia, whose name Lessing first intended to give to the play.

**EMILIA VIA**. See **EMILIA**; **ÆMILIAN WAY**.

**EM'ILY**. The pretty niece of the retired sailor Peggotty, in Dickens's *David Copperfield*, better known by her uncle's affectionate diminutive for her name, Little Em'ly.

**EMINENCE** (Fr. *éminence*, Lat. *eminentia*, from *eminere*, to jut forth, from *e*, out + *minere*, to jut). A title applied in the later period of the Roman Empire to the emperors and afterward to the higher officials of the Empire. Gregory the Great authorized its application to the higher dignitaries of the church. It was restricted in 1630 by Urban VIII to cardinals, the three ecclesiastical electors of the German Empire (the archbishops of Treves, Mainz, and Cologne), and the Grand Master of the Knights of St. John. With the disappearance of the latter two classes, the title has come to be applied to cardinals only.

**ÉMINENCE GRISE**, á'mē'nāns' gréz, L' (Fr., the gray cardinal). The nickname given to the Capuchin François Leclerc du Tremblay (Father Joseph), the confessor of Cardinal Richelieu. (See **EMINENCE ROUGE**.) A painting by Gérôme represents him descending the palace stairway of his master, greeted by an obsequious throng in front and followed by hostile gestures, to both of which he pretends to give no heed. It was acquired by the Boston Museum of Fine Arts in 1903 for \$16,000.

**ÉMINENCE ROUGE**, rôozh, L' (Fr., the red cardinal). A popular nickname of Cardinal Richelieu, from his scarlet robes.

**EMINENT DOMAIN**. In modern public law, the right of the sovereign to appropriate the property of the subject for public purposes. This right is an incident of sovereignty and not of the paramount title which, under the feudal system of land tenure in England and elsewhere, the state enjoys. It has no affinity, therefore, with the state's right of escheat on failure of heirs, and of forfeiture for treason or felony, which, whether tenure does or does not exist in a given jurisdiction, are survivals of the feudal relation of lord and tenant. Eminent domain is more nearly allied to the state's right to take the property of its subjects or citizens by taxation, and in the exercise of the wide range of public functions comprehended

under the police power. It differs from the power of taxation in the fact that the latter always involves the notion of the equal distribution of a public burden among a number of persons, and from the exercise of the police power in that eminent domain contemplates the taking of property for use, and not its destruction, in the public interest. Neither can the exercise of this power, however arbitrarily made, be described as confiscation, as it is (1) always exercised under forms of law, (2) for the public good, and (3) in practice, at least, by making compensation for the property taken. Though usually applied to real property, the right of eminent domain extends equally to personal property. Though the term is of foreign origin and found its way into our law through its employment by Grotius, Vattel, and certain English jurists, and though it is everywhere recognized as an attribute of sovereignty, it is nowhere else in such common use as in the United States. This is doubtless due to the restraints upon the exercise of the right provided by our constitutional system, which have resulted in an elaborate judicial commentary upon its nature and the methods and conditions on which it may be exercised. Since it relates to the exercise of the sovereign power, it is in legal theory completely unfettered in those nations in which the sovereign power is wholly committed to the government. In such states, if compensation be made for property taken under the exercise of this right, it is as an act of grace and not of legal obligation. Thus, while in fact the British Parliament always provides for making due and reasonable compensation to the owner of property so taken, it is not bound to do so, nor does the validity of the exercise of the power in a given case depend at all on such provision.

Blackstone, it is true, argues that the right of the subject to compensation is a common-law right, and that the legislature can do no more than compel the owner to alienate his land for a reasonable price; but Blackstone wrote without adequate knowledge of the powers of Parliament. The statement is strictly true of the exercise of the power of eminent domain in most of the United States; but this is due to the existence of constitutional provisions by which the power of Congress and of the State legislatures is restricted, and not to any general rule of the common law.

The right of eminent domain resides in the several States of the United States as an incident of their sovereignty, and it is one of the implied powers vested in Congress by the Constitution. The restriction of the Federal Constitution upon its exercise by Congress is in the clause which declares that no person shall be "deprived of life, liberty, or property without due process of law"; and that private property shall not "be taken for public use without just compensation" (Amendments, Art. V). The Fourteenth Amendment provides that no State shall "deprive any person of life, liberty, or property without due process of law." Whether this restricts the States in exercising the power of eminent domain has not been decided, but all the States except North Carolina have bound their legislatures by similar constitutional provisions, many of the States requiring that compensation shall be made in advance. It may therefore be regarded as a part of the constitutional law of the United States that no person

can lose his property by eminent domain except it be taken (1) for public use, (2) by due process of law, and (3) for just compensation. The courts will declare unconstitutional and void any act of Congress or of a State legislature which transcends these restrictions.

The phrase "public use" has been liberally interpreted by the courts. It is held to include not only public improvements carried on directly by the State, as the construction of harbors, canals, fortifications, the erection of lighthouses and other public buildings, etc., but also private or quasi-public enterprises in which the public have an interest, as railroads, ferries, turnpikes, bridges, mills, etc. In the latter class of cases the State may act through a corporation or individual, acting as its agent, and it is no objection to the exercise of the power that it involves gain or is sought for purposes of gain by such agent.

As to what constitutes "due process of law" in such cases there is some difference of opinion. The usual procedure is by condemnation proceedings, the course of which is determined by general law. These are instituted, like any equity suit, by petition presented to a court of competent jurisdiction, and hearings may be had, either by the court or before a master or referee appointed for the purpose. The final step in such a proceeding is an order of condemnation and award, which is binding like any other judicial decree or judgment. But the legislature may substitute any other process, no matter how summary, provided only that notice of the proceedings is given to the owner of the property to be taken.

Just compensation means payment of the full value of the property taken or of any interest therein, whether present or future, vested or contingent. There has been some conflict of authority as to whether the flooding of lands or the construction and operation of an elevated railroad to the detriment of adjoining owners constitutes a "taking" of property within the sense of the constitutional provision, but the later and the prevailing view is that the owner is entitled to compensation in such cases. But for merely consequential damages resulting from public works, he must usually look for relief to other provisions of law or to the legislature.

Consult: Kent, *Commentaries on American Law*; Mills, *Eminent Domain* (2d ed., St. Louis, 1888); Lewis, *Eminent Domain* (2d ed., Chicago, 1900); Randolph, *Eminent Domain* (Boston, 1894); Cooley, *Treatise on the Constitutional Limitations which Rest upon the Legislative Power of the State* (7th ed., ib., 1903); Thayer, *Cases in Constitutional Law* (ib., 1894). See SOVEREIGNTY; TAX; POLICE POWER.

**EMINESCU**, ă-mē-ně'skōō, MICHAEL (1850-89). A Rumanian poet and publicist. He was born near Botoshani, Moldavia, and was educated at the universities of Vienna and Berlin, where he became imbued with Schopenhauer's philosophy. After his return to Rumania he successively became librarian at the University of Jassy and editor of the conservative paper *Timpul*, in Bucharest. He published his most accomplished poems in the periodical *Convorbiri literare* (Literary Conversations), the organ of the society *Junimea* (Youth). During the later part of his life he was insane. In his poems, which treat of a great variety of subjects—political, social, and religious—and which afford an insight into the deep emotional

experiences of the author, Eminescu reveals himself as the greatest lyricist of Rumania. Among his finest productions are his sonnets and his political satires. His poetical productions are characterized by plasticity of expression, reverence of the national past, and a spirit of lofty pessimism. The first edition of his collected works was published at Bucharest, under the title *Poesii* in 1884 (6th ed., 1892). Several of his poems have been translated into German by Carmen Sylva and others. Consult Bogdan, "Metrik Eminescus," in *Jahresberichte des Instit. für Rumän. Sprache*, vol. xi (Leipzig, 1904), and Scurtu, *E. Leben und Prosaschriften*, vol. x (id., 1904).

**EMIN PASHA**, ă'mēn pâ-shū' (1840-92). An African explorer and governor in the Egyptian Sudan. He was born at Oppeln, Prussia, of Jewish parents, his real name being Eduard Schnitzer. He studied at Breslau, Berlin, and Königsberg, taking his degree in medicine. He went to Turkey in 1864, where in the following year he received an appointment as quarantine and medical officer in the Turkish army, and in 1875 he removed to Egypt, where he became government medical officer of the Egyptian army in the Sudan under the command of General Gordon. In 1878 he was appointed by General Gordon Governor of the equatorial provinces in the southern Sudan, with the title of Bey. Emin proved himself an able administrator, and in two years the provinces, which had hitherto been a source of expense to the Egyptian government, became self-supporting. He personally conducted exploring expeditions, adding greatly to the geographical knowledge of Central Africa and securing valuable collections of botanical and zoological specimens.

After the revolt of the dervishes under the Mahdi in 1881 he was completely cut off from Egypt and the rest of the world, but was able to maintain himself and keep the provinces under his control. While he was still isolated from the civilized world, he was made a pasha by the Egyptian government (1887). In the following year he was rescued by an expedition led by Henry M. Stanley, who tried in vain to induce Emin to return with him to Egypt; but the Pasha would not leave his people, to whom he was devoted. In the following year, however, influenced by representations of the dervishes, the provinces rose in revolt, and Emin was deposed and imprisoned. On being released he reluctantly left the country and, returning to Egypt, resigned his office. A year later (1890) he entered the service of the German East Africa Company and accompanied Dr. Stuhlmann on an expedition to Central Africa. It was while engaged in this work, which he prosecuted with heroic energy in spite of almost extinct eyesight, that he was assassinated by two Arabs. Consult: Buchta, *Der Sudan unter ägyptischer Herrschaft* (Leipzig, 1888); Stanley, *In Darkest Africa* (New York, 1890); Schynse, *Mit Stanley und Emin Pascha durch Deutsch-Ost-Africa* (Cologne, 1890); Schweitzer, *Emin Pascha* (Berlin, 1898); P. Reichard, *Emin Pascha* (Leipzig, 1891); Vita Hassan, *Die Wahrheit über Emin Pascha* (Berlin, 1895); G. Casati, *Ten Years in Equatoria and the Return with Emin Pascha* (London, 1898); F. Stuhlmann, *Mit Emin Pascha ins Herz von Africa* (Berlin, 1894); C. Peters, *Die deutsche Emin Pascha Expedition* (München, 1891); Emin Pasha, *Eine Sammlung von Reisebriefen u.s.w.*, ed. by G.

Scheinfurth and F. Ratzel (Leipzig, 1888); *Emir Pasha in East Africa* (London, 1898).

**EMIR**, or **AMEER**, ʿēmēr or ā-mēr (Ar. 'amir, prince, from 'amara, to be prince, Ar. pl. *Umarā*, leader, commander, in Greek transcribed 'Αμῆρ, 'Αμῖρ, or 'Αμῖρας, Lat. *amiratus*, *amiralius*, whence the word admiral, etc.; in Persian pronunciation often abbreviated to *Mir*). A title given in Central and western Asia and northern Africa to independent chieftains, and actual or supposed descendants of Mohammed through his daughter Fatima. The latter are nominally members of the first four social orders, but have few special privileges except the right to wear turbans of green, the Prophet's color. The number claiming this descent is considerable, but they are often beggars. The leaders in the earlier religious wars of the Mohammedans had the title of emir, and it was borne as a title of nobility by several families of high rank—as, e.g., the first heads of the Ommiads of Spain. As a title the word is used with others to denote distinct offices, such as 'Amir al-Mu'minin, 'prince of the faithful,' a title of the caliphs. 'Amir al-Muslimin, signifying the same thing, was a title adopted by the Almoravides. 'Amir el-'Umarā', 'prince of princes,' was the title of the first minister under the caliphs and the East Indian Moguls, who united in his own person the highest civil and military dignities. It is now the title of the governors of different provinces. The Turkish master of the horse is styled 'Amir akhur; the standard bearer, 'Amir al-'Alam; and the leader of the caravans of pilgrims to Mecca, 'Amir al-Hajj.

**EMISSION THEORY OF LIGHT.** See **LIGHT**; **NEWTON**, **SIR ISAAC**.

**EM'MA**, **ADÉLAIDE WILHELMINA THÉRÈSE** (1858—). Queen regent of the Netherlands from 1890 to 1898. She was born at Arolsen, Germany, the second daughter of Prince George Victor of Waldeck. She was married to King William III of Holland, Jan. 7, 1879, by whom she had one daughter, Queen Wilhelmina of Holland. After the death of William III (Nov. 23, 1890) she conducted the regency until the accession of her daughter to the throne, Sept. 6, 1898. She took an active interest in charities, especially hospitals for consumptives.

**EMMANUEL**, or **IMMANUEL** (Heb., God is with us). A name occurring in Isa. vii. 14 and viii. 8 and referred to with a special application to Jesus in Matt. i. 23. The historical connection of the name is as follows: Ahaz, King of Judah, stood in fear of a threatened siege of Jerusalem by Rezin, King of Damascus, and Pekah, King of Israel. Isaiah tells Ahaz not to fear and assures him that the threatened invasion will never come about; and as a sign for this he, unasked, says that a young woman will bear a son who will be called Immanuel, and who, while quite young, will witness the destruction of both kings. Most modern scholars see in the name no reference to Jesus and maintain that the context precludes the interpretation put upon the passage by Matthew. Just who the young woman was is a mooted question. By some she is identified with the wife of Ahaz—the child would then be Hezekiah; by others with the wife of the prophet; by still others the young woman is supposed to be indefinite and the word to mean any young woman. Consult: Porter, "A Suggestion Regarding Isaiah's Immanuel," in *Journal of Biblical Literature*, vol. xiv, pp. 19 ff. (Boston, 1895); Cheyne, *In-*

*troduction to the Book of Isaiah* (New York, 1895); Duhm, *Das Buch Jesaja* (2d ed., Göttingen, 1902); Marti, *Jesaja* (Tübingen, 1900); Box, *The Book of Isaiah* (New York, 1910).

**EMMANUEL COLLEGE.** A college of Cambridge University. It was founded in 1584 by John Mildmay, sometime Chancellor of the Exchequer under Queen Elizabeth, for a master and 13 fellows. From the first it was a "nursery of Puritanism," as Laud called it, a number of those emigrating to America in the first half of the seventeenth century being of this college. The most noted, John Harvard, gave his library and half his fortune to the American college which bears his name. There were, in 1913, 13 fellowships, 28 scholarships, besides exhibitions and prizes. There were 122 undergraduates in the same year. The college has the presentation of a number of livings and schools. Among noted men who belonged to the college are Archbishops Sancroft and Cudworth, who were masters of the college; Sir William Temple, Samuel Parr, and Bishop Hall. Consult E. S. Shuckburgh, *Emmanuel College* (London, 1904).

**EMMAUS**, ʿēm'mā-ūs (Gk. Ἐμμαούς, *Emmaous*). A village referred to in Luke xxiv. 13, as located "threescore furlongs from Jerusalem." The identification of its site is much disputed. 1. The early traditional location is the Emmaus (the modern *'Amwās*, about 15 miles west by north of Jerusalem, near the old Roman road to Jaffa), where Judas Maccabæus won his great victory over the Syrian general Gorgias (1 Macc. iii. 40, 57; iv. 3–25) and which Bacchides later fortified (1 Macc. ix. 50). In Roman times it was the capital of one of the 10 toparchies into which Judæa for a while was divided (Pliny, *Hist. Nat.*, v. 14, 70; Josephus, *Wars*, III, iii, 5, gives a different list, which totals 11; both lists, however, include Emmaus). From the time of Julius Africanus (third century) it was given the name of Nicopolis, for what reason, however, is not definitely known (consult Schürer, *History of the Jewish People*, Eng. trans., I, ii, 253, note; II, i, 157, 159, note). The distance of this place from Jerusalem makes it impossible, in spite of its name, to consider it the village referred to by Luke. 2. From the twelfth or fourteenth century a later tradition has located the site at the modern village of *El-Kubebek*, some 60 furlongs northwest from Jerusalem, on the road to Lydda. In favor of this location is the distance, to which may be added the fact that in 1099 A.D. the Crusaders found the name *Castellum Emmaus* attached to the place, and in laying the foundations of their church cut through an older, probably Byzantine, building. (Consult Sanday, *Sacred Sites*, p. 92.) 3. Josephus tells us that after the Jewish War Titus planted a colony of 800 veterans at a village called Emmaus, 30 stadia from Jerusalem (*Wars*, viii, vi, 6). Recent opinion seems to be inclined to identify this village with the modern *Kalōniyeh*, some 35 furlongs from Jerusalem, on the road to Jaffa. In its favor is the evidence borne by the name to the colonizing of the place, just as *Lejjūn*, the modern name of Megiddo, is derived from the fact that a Roman legion was stationed there (consult Sanday, *Sacred Sites*, p. 30). As between these two latter sites, it may be impossible definitely to decide, though either of them is more probable than the first of the three. Conder's identification with the modern *Khamasah*, some 70 furlongs south-

west of Jerusalem, has a similarity of name and distance, but lacks any evidence from early literature. Consult: Schürer, *History of the Jewish People* (Eng. trans., 5 vols., New York, 1896); Sanday, *Sacred Sites of the Gospels* (Oxford, 1903); and the Bible Dictionaries.

**EMMENAGOGUES** (from Gk. ἐμμηνα, *em-mēna*, menses, from ἐν, *en*, in + μήν, *mēn*, month + ἀγῳγός, *agōgos*, leading, from ἄγειν, *agein*, to lead). Medicines intended to restore, or to bring on for the first time, the menstrual flow in women. Menstruation temporarily arrested by cold, shock, etc., may be restored by warm hip baths, or sitz baths, hot mustard foot baths, and hot drinks at night. *Indirect* emmenagogues, such as iron, quinine, strychnine, manganese, cod-liver oil, etc., act by toning up the nervous system and combating anæmia. Fresh air, outdoor exercise, and sea bathing are often efficacious in the same way. *Direct* emmenagogues act as local stimulants to the uterus. They are very numerous. The most common are ergot, savin, tansy, asafoetida, rue, apiol, and myrrh. Purgatives such as aloes are useful adjuncts in the treatment of this condition. See **MENSTRUATION**.

**EMMENDINGEN**, ém'mēn-dīng-en. A town in Baden, Germany, on the Elz, 9 miles north of Freiburg. Two modern churches, the Rathaus, and statues of the margraves Jakob III, Karl II, and Prince Bismarck are among its principal features. It has breweries and manufactures of silk, leather, photographic supplies, thread, machinery, art objects, bricks, rope, paper, tobacco, and cigars. It works stone quarries and has a trade in sea grass, wood, hemp, tobacco, and cattle. Crowning a hill 3 miles to the west are the extensive ruins of the Hochburg fortress, dismantled by command of Louis XIV in 1689, and now used as an agricultural school. Pop., 1900, 6202; 1910, 8379.

**EM'MENSITE**. An explosive produced by dissolving picric acid in nitric acid and mixing the crystals obtained with a nitrate, such as ammonium nitrate.

**EMMENTHAL**, ém'mēn-tāl. An Alpine valley in the Canton of Bern, Switzerland, one of the most picturesque and fertile in the country (Map: Switzerland, B 2). It is about 25 miles long, 10 to 12 miles wide, and is traversed by the Grosse Emme and the Ilfis rivers. It raises a fine breed of cattle. The chief town in the valley is Langnau (q.v.).

**EMMER**. See **SPELT**.

**EMMERAM**, ém'mēr-ām, or **EMMERAN**, SAINT (?—c.715). A South-German missionary, of a noble family of Aquitaine. He may have been Bishop of Poitiers. He had determined to convert the pagans of Pannonia, but was prevailed upon by the Bavarian Duke Theodo to labor in Bavaria. After rendering effective services there as a missionary during a period of three years, he undertook a pilgrimage to Rome, but was slain (according to legend on the 22d of September—now his festival; in 715 according to the best authorities; but before 696 or as early as 652 according to others) within a short distance of Regensburg by the son of the Duke, to avenge his sister's dishonor, which had been unjustly imputed to Emmeram. He was buried at Regensburg, where he had established an abbey, and where the abbey church bearing his name was built in the thirteenth century. His relics are shown there each year on the 22d of September.

**EMMERAN**, ém'mēr-ān, **EUSEBIUS**. See **DAUMER**, GEORG FRIEDRICH.

**EMMERICH**, ém'mēr-ik. A town in the Prussian Rhine Province, on the right bank of the Rhine, about 57 miles northwest of Düsseldorf and 5 miles from the Dutch frontier (Map: Prussia, B 3). The streets are broad and clean and the houses distinctly Dutch. Two of its churches are worthy of notice—that of St. Aldegund, a handsome Gothic edifice of the fifteenth century, and the Münster or church of St. Martin, with a fine crypt, a tower of the fifteenth century, carved choir stalls, and the shrine of St. Willibrord, with a golden casket of the eighth century. The town owns its gas and water works and has manufactures of liqueurs, chocolate, chemicals, leather, pianos, brushes, hosiery, oleomargarine, machinery, oil, vinegar, soap, cigars, and tobacco. Its river trade is considerable, consisting largely of produce, cattle, and Rhine salmon. Pop., 1900, 10,517; 1910, 13,418. Emmerich dates from the seventh century. In 1233 it came under the dominion of the counts of Geldern, by whom it was raised to the rank of a city, but in 1402 it passed to Cleves. In 1407 it belonged to the Hanseatic League and is believed to have contained then a population of 40,000. It subsequently shared the fortunes of the Duchy of Cleves.

**EMMERICH**, ANNA KATHARINA (1774–1824). A German nun and visionary. She was born in Westphalia and from 1803 to 1811 lived at the Augustinian monastery of Agnetenberg, near Dülmen. Like Veronica Juliani, Maria von Mörl, and others, she was believed to have been stigmatized and was particularly celebrated for her revelations and ecstatic visions of the Passion. An episcopal commission and later (1819) one from the government examined her with great care. The case seems one of the best attested of stigmatism. Her experiences were described by Clemens Brentano (Munich, 1852), whom she is said to have known from a vision and who took down her own story; and by the Abbé Cazalès (Paris, 1870). Consult Wegener, *Anna Katherine Emmerich* (New York, 1907; Eng. trans. by McGowan), and the translation of the *Passion*, with biography, by a Benedictine priest (Clyde, Mo., 1914). See **STIGMATIZATION**.

**EMMERICH**, RUDOLF (1852– ). A German physician, born in Mutterstadt in the Rhine. In the Franco-Prussian War he served in a volunteer medical corps. He became an assistant to Von Pettenköfer and Hoffmann in the University of Leipzig, where he took his doctor's degree in 1880, and in 1887 became extraordinary, and in 1902 regular, professor of hygiene and bacteriology in the University of Munich. His more important work was on the cholera bacillus, especially in Constantinople, whither he was summoned in 1895 by the Sultan, and more generally on the bactericidal action of blood serum from artificially immunized animals; and he wrote on housing and hygiene.

**EMMERPACH**, J. See **AMERRACH**, J.

**EMMERSON**, HENRY ROBERT (1853–1914). A Canadian lawyer and statesman. He was born in Maugerville, New Brunswick, and was educated at Amherst Academy and Boston University. He studied law, was called to the bar, and practiced his profession at Dorchester, where he became a leader of the bar. In 1888–

90 and in 1892-1900 he was a Liberal member of the Provincial Legislature, and in 1891-92 he served in the Legislative Council. For the first five years of his second parliamentary term he was Minister of Public Works, and in 1897-1900 he was Premier and Attorney-General. In 1904-07 he was a member of the Dominion House of Commons and Minister of Railways and Canals in the administration of Sir Wilfrid Laurier. He published *The Legal Condition of Married Women*, besides pamphlets and lectures.

**EMMET, LYDIA FIELD** (1866- ). An American portrait painter. She was born at New Rochelle, N. Y., and studied under Bouguereau and Fleury in Paris and at the Art Student's League, New York. She is especially known for her portraits of children, which show sympathetic psychological insight, unconventional composition, and resourceful though not brilliant color. She received medals at the Exposition of Chicago (1893), Atlanta (1896), and St. Louis (1905), and gained the Shaw prize in 1906, the Proctor prize in 1907, and the Clarke prize in 1909—all at the exhibitions of the National Academy of Design, of which she was elected member in 1912.

**EMMET, ROBERT** (1778-1803). An Irish patriot and orator. The third and youngest son of Dr. Robert Emmet, an Irish state physician, he was born in Dublin. After education at private schools he became a distinguished prize winner at Trinity College, Dublin, and an eloquent member of the Historical Society. Summoned before the faculty and governmental visitors in 1798, he resigned from college, in protest against its political domination, and traveled on the Continent, where in 1802 he had interviews with Napoleon and Talleyrand. Napoleon promised to aid Irish independence, and Emmet returned secretly to Ireland, with the idea of planning a general revolution. On July 23, 1803, an immature rising took place. Emmet, dressed in a green and white attire and attended by 100 or more conspirators, marched to seize Dublin Castle. On their way the men with pikes murdered the aged Lord Kilwarden, whom they met in his carriage, and assassinated Colonel Brown of the Fourth Regiment, who was walking on the Coombe. Emmet was in despair at these excesses, and after the ordinary guard with their first volley had dispersed the rioters, he fled to the Wicklow mountains, intending to escape to the Continent or to America. His affection for Curran's daughter led to his arrest when seeking a final interview with her. He was tried for treason, condemned to death, and hanged the following day, Sept. 20, 1803. His speeches delivered before receiving sentence and on the scaffold are held to be models of patriotic eloquence. "O Breathe not his Name," and "She is Far from the Land where her Young Hero Sleeps," two of the most pathetic poems of his college friend, Moore, commemorate the sad fates of Emmet and Miss Curran. Consult: Madden, *Life and Times of Robert Emmet* (Glasgow, 1902); T. A. Emmet, *The Emmet Family* (New York, 1898); O'Donoghue, *Life of Robert Emmet* (Dublin, 1902); *Robert Emmet: Cause of his Rebellion* (London, 1871).

**EMMET, ROSINA.** See **SURWOOD, ROSINA.**

**EMMET, THOMAS ADDIS** (1764-1827). An Irish lawyer and politician. An elder brother of Robert Emmet, he was born in Cork. He obtained a scholarship and the degree of B.A. at Trinity College, Dublin, and the degree of M.D.

at Edinburgh University. On the advice of Sir James Mackintosh, however, he abandoned medicine for law, and was admitted to the Dublin bar in 1790. As counsel of the United Irishmen, he was arrested with others for treason and imprisoned from 1798 to 1802. He regained his freedom as a political exile, forbidden to re-enter British territory under heavy penalties. He visited Hamburg, Brussels, and France, where, upon his brother's condemnation and execution, he interviewed Napoleon, who was contemplating an invasion of England. Finally he went to New York and joined the American bar. He gained distinction and a large practice, and in 1812 was elected Attorney-General of New York State. He died suddenly while pleading in court. He wrote sketches of Irish history for McNevin's *Pieces of Irish History* (1807). Consult: Haynes, *Life of Thomas A. Emmet* (London, 1829); Madden, *Memoir* (New York, 1856); T. A. Emmet, *The Emmet Family* (ib., 1898).

**EMMET, THOMAS ADDIS** (1828- ). An American gynecologist, born at Charlottesville, Va. His father, Dr. John Patten Emmet, was professor of chemistry and materia medica at the University of Virginia. His grandfather was Thomas Addis Emmet, an Irish lawyer and a leader of the United Irishmen, afterward Attorney-General of the State of New York; and his granduncle was the Irish patriot Robert Emmet. After a partial academic course at the University of Virginia Dr. Emmet received his medical degree from the Jefferson Medical College of Philadelphia in 1850. He then acted for two years as physician in the Emigrant Hospital, Ward's Island, and after 1852 practiced medicine in New York City. From 1855 to 1862 he was also assistant surgeon, from 1862 to 1872 surgeon in chief, and from 1872 to 1900 visiting surgeon, in the Women's Hospital of the State of New York. In 1876 he was appointed consulting physician to Roosevelt Hospital, New York City. His chief literary work is his *Principles and Practice of Gynecology* (1879). He wrote also *Ireland under English Rule* (2 vols., New York, 1903).

**EMMETSBURG.** A city and the county seat of Palo Alto Co., Iowa, about 120 miles (direct) north-northwest of Des Moines, on the Des Moines River, and on the Chicago, Rock Island, and Pacific, and the Chicago, Milwaukee, and St. Paul railroads (Map: Iowa, C 1). It is in an agricultural, dairying, and stock-raising region and has grain elevators, flouring mills, creameries, and brick and tile and cement works. Emmetsburg contains a fine lake and a Carnegie library and owns its water works. Pop., 1900, 2361; 1910, 2325.

**EMMETT, DANIEL DECATUR** (1815-1904). An American actor and song writer, originator of "negro minstrel" performances. He was born at Mount Vernon, Ohio, and, after serving in the army, joined a circus company in 1835. In 1842, in association with "Frank" Brown, "Billy" Whitlock, and "Dick" Phelam, he organized the "Virginia Minstrels," which made its first appearance at the old Chatham Square Theatre, New York City, Feb. 17, 1843, and subsequently appeared in Boston and in New York City. Emmett remained until 1844. He composed the famous song of *Diwle*, afterward the war song of the South. Among his popular songs were "Old Dan Tucker," "Boatman's Dance," "The Road to Richmond," "Walk Along,

John," and "Early in the Mornin'." Consult Galbreath, *Daniel D. Emmet* (Columbus, Ohio, 1905).

**EMMINGHAUS**, ɛm'ming-hous, KARL BERNHARD ARWED (1831- ). A German political economist, born at Niederrossla (Saxe-Weimar), and educated at Jena. He became editor of the *Bremer Handelsblatt* in 1861 and from 1866 to 1873 was professor of agricultural science in the Polytechnical School of Karlsruhe. Later he was elected director in chief of the German Life Insurance Bank at Gotha. In 1903 he retired to private life. His works on political economy include: *Allgemeine Gewerkslehre* (1868); *Das Armenwesen und die Armengesetzgebung in europäischen Staaten* (in collaboration, 1870); *a Geschichte der Lebensversicherungsbank für Deutschland zu Gotha* (1877); *Ernst Wilhelm Arnoldi, Leben und Schöpfung eines deutschen Kaufmanns* (1878).

**EMMITSBURG**. A town in Frederick Co., Md., 60 miles northwest of Baltimore, on the Western Maryland Railroad (Map: Maryland, E 1). In the vicinity are Mount St. Mary's College and Seminary (Roman Catholic), opened in 1803, and St. Joseph's College and Academy, conducted by the Sisters of Charity. The city contains a public library and a museum. Its industries include cattle raising and the manufacture of furniture, brooms, and hosiery. Settled about 1757, Emmitsburg received its present name in 1785, was incorporated in 1824, and under a charter of 1911 is governed by a burgess and three commissioners. Pop., 1900, 849; 1910, 1054.

**EMMONS**, EBENEZER (1799-1863). An American geologist, born in Middlefield, Mass. He was educated at Williams College, where he filled for a time the professorship of natural history. His research work in geology and mineralogy secured for him a position in the New York State Natural History Survey, as geologist in chief of the second district. As a result of his investigations in this field and in the New England States, he introduced a new stratigraphic division, the Taconic system (q.v.), to include a group of limestones and metamorphosed rocks that were thought to underlie the Silurian. His views in favor of the independence and unity of the system were supported for a long time by many good authorities, but it is now generally conceded that the Taconic rocks are the equivalents of Cambrian and Silurian strata. In 1838 Emmons was appointed to the chair of chemistry in the medical college at Albany, and in 1858 he was placed in charge of the geological survey of North Carolina. His most important works are: *Manual of Mineralogy and Geology* (1826); *American Geology* (1856); and the monographs published in the reports of the geological surveys of New York and North Carolina.

**EMMONS**, GEORGE FOSTER (1811-84). An American naval officer. He was born in Clarendon, Vt., entered the navy as a midshipman in 1828, took part in the Wilkes exploring expedition of 1838-42, and served along the California coast during the Mexican War. In the Civil War he served as commander of the *Hatteras*, capturing Cedar Keys, Fla., and Pass Christian, Miss., in 1862; was fleet captain under Dahlgren, off Charleston, in 1863; and in 1864-65 commanded a division in the Gulf of Mexico. As commander of the *Ossipee*, in 1867-68, he carried to Alaska the commissioners who took

formal possession for the United States. He became commodore in 1868, chief of the Hydrographic Office in 1870, and rear admiral in 1872, and in 1873 retired from the service. He wrote *The Navy of the United States from 1775 to 1853* (1853).

**EMMONS**, NATHANAEL (1745-1840). An American Congregational theologian. He was born at East Haddam, Conn., April 20, 1745, and graduated at Yale College in 1767. In 1773 he was ordained pastor of the Congregational Church in Franklin, Mass., and continued in the office 54 years. He was one of the originators of the Massachusetts Missionary Society and one of the editors of its missionary magazine, from which the *Missionary Herald* grew. He was a man of decided opinions and some eccentricity, an opponent of Freemasonry, a sympathizer with the antislavery movement, a strong Federalist, and an influential preacher. He died in Franklin, Mass., Sept. 23, 1840. Consult his *Collected Works*, with memoir by his son-in-law, Jacob Ide (New York, 1842); also Park, *Memoir of Nathanael Emmons* (Andover, 1861).

**EMMONS**, SAMUEL FRANKLIN (1841-1911). An American geologist, born in Boston, Mass. He graduated in 1861 at Harvard, studied in 1862-64 at the Ecole Impériale des Mines, Paris, in 1864-65 at the Freiberg (Saxony) Mining School, and in 1867 was appointed assistant geologist for the United States exploration of the fortieth parallel. In 1879 he was appointed geologist of the United States Geological Survey, in charge of the Colorado Division. He made a survey in 1870 of Mount Rainier, the loftiest point in the State of Washington. In 1903 he was president of the Geological Society of America. His publications include: "Descriptive Geology" (vol. ii of *Reports of the Exploration of the Fortieth Parallel*, 1877); *Statistics and Technology of the Precious Metals* (1885); *Geology and Mining Industries of Leadville, Col.* (1886); *Geology of Lower California* (1890); *Geology of the Denver Basin in Colorado* (1896); *Ten-mile District Special Folio, Colorado* (1898); *The Downtown District of Leadville, Colorado* (1907); *Ore-Deposits* (1913).

**EMOLLIENT** (from Lat. *emollire*, to soften, from *e*, out + *mollire*, to soften, from *mollis*, soft). Any substance used to soften the textures to which it is applied, as an ointment, poultice, fomentation, etc., externally, and demulcents (q.v.) internally. Examples of emollients are, in addition to the above, glycerin, lard, linseed oil, petrolatum, soap liniment, and cacao butter.

**EMORY**, JOHN (1789-1835). An American Methodist Episcopal bishop. He was born in Queen Anne Co., Md., studied at Washington College (Chestertown, Md.), was admitted to the bar in 1808, in 1810 was received on trial as a minister of the Methodist Episcopal church, and from 1813 to 1824 held various important appointments. In 1824 he became book agent and editor for the Methodist Episcopal church in New York City. He canceled the debt of the Methodist Book Concern and placed it upon a sound financial basis. He was elected a bishop in 1832 and assisted in the organization of Dickinson College (Carlisle, Pa.). He also originated in 1830 the new series of the *Methodist Magazine*, known as the *Methodist Magazine and Quarterly Review*, to the first two volumes



of which he contributed most of the original articles. His public writings include: *The Defence of Our Fathers* (1824) and *The Episcopal Controversy Reviewed* (1838), a reply to Bishop Onderdonk's *Episcopacy tested by Scripture*. Consult the biography by his son, Robert Emory (New York, 1841).

**EMORY, ROBERT** (1814-48). An American clergyman of the Methodist Episcopal church, son of John Emory. He was born in Philadelphia, Pa., graduated at Columbia in 1831, studied law, and in 1834 became professor of ancient languages at Dickinson College (Carlisle, Pa.), of which he became president in 1845. He published *A Life of the Rev. John Emory*, his father (1841), and a *History of the Discipline of the Methodist Episcopal Church* (1843), and edited an *Analysis of Butler's Analogy*, completed by G. R. Crooks (1850).

**EMORY, WILLIAM HEMSLEY** (1811-87). An American soldier, born in Queen Anne Co., Md., cousin of John Emory. He graduated at West Point in 1831, served on the staff of General Kearny in California during the Mexican War, and was afterward a member of the commission appointed to determine the boundary line between Mexico and the United States. In the Civil War he was promoted brigadier general United States Volunteers in March, 1862, served under McClellan in the Peninsular campaign, commanded the Nineteenth Corps under General Banks, in the Red River expedition of 1864, and afterward against Early in the Shenandoah valley. In September, 1865, he attained the full rank of major general of volunteers. He afterward commanded successively the departments of West Virginia, of Washington, and of the Gulf, and in 1876 retired with the full rank of brigadier general. He wrote: *Notes of a Military Reconnaissance from Fort Leavenworth in Missouri to San Diego in California* (1848), a "narrative" in J. C. Frémont's *Notes on Travel in California* (1849), and a large part of the *Report of the United States and Mexican Boundary Commission* (2 vols., 1857-59).

**EMORY, WILLIAM HEMSLEY** (1846- ). An American naval officer. He was born in Washington, D. C., and graduated from the United States Naval Academy in 1866. Promoted through the successive grades, he became captain in 1901 and rear admiral in 1906. His commands include the *Bear* (1884), the *Despatch* (1885-86), the *Thetis* (1887-89), the *Petrel* (1894-96), the *Yosemite* (1898-1900), the *Monongahela* (1901), the *Indiana* (1901-03), and the *Hancock* (1904-06). He also served at the Naval Observatory and the Naval Academy, and was naval attaché in London. In 1907 he commanded the Second Squadron of the Atlantic Fleet, and in the following year he was retired.

**EMOTION** (from Lat. *emovere*, to agitate, from *e*, out + *movere*, to move, Skt. *mv*, to push). A highly complex mental process, or mental formation, belonging to the affective side of our nature. (See **AFFECTION**.) It includes all such experiences as joy and sorrow, hope and fear, anger and disgust. Its place in systematic psychology will be most easily understood by a comparison of the results of introspective analysis in the two great mental departments of intellect and feeling. We begin, in our treatment of these aspects of mind, with the simple elements of sensation and affection. Above the elements, in order of increasing complexity, stand

the perception or idea and the sense feeling—e.g., the perception of locality when we are touched upon the skin, and the feeling of drowsiness that comes with bodily fatigue. Above these, again, stand the association of ideas and the emotion; while at the final level of complexity we have the judgment, or the processes of the constructive imagination, and the various forms (aesthetic, moral, etc.) of sentiment. Since the highest functions both of intellect and of feeling are the prerogative of the most highly developed minds, and rarely occur in the experience of the average man, it is clear that for most of us and upon most occasions emotion is typical of the affective consciousness at large.

Let us now trace the genesis of an emotion, in order that we may have a concrete basis for future analysis. Suppose that a man is engaged in his ordinary vocation, pursuing indifferently the work that lies before him, when a letter arrives which contains a piece of bad news. The current train of ideas is sharply interrupted; there is a break in thought; the current of consciousness is changed, or (as we may say, in accordance with the definition of consciousness (q.v.) as "mind now") a novel consciousness is set up. The focal point of the new consciousness is occupied by the perception of the unwelcome tidings. If the news be overwhelmingly bad, this perception may stand almost alone; there is inhibition of other ideas, a sort of paralysis of the mind, a state of what the French term "monoideism." If it be disagreeable, but not overwhelming, all sorts of related ideas will cluster round the central perception—ideas of the consequences of the reported occurrence for one's life in the future, of its effect upon one's self and others in whom one is interested, of ways and means of mitigating the disaster—so that the perception expands to a simultaneous association of ideas or (in technical language) to an assimilation. In either case we must note that the item of news has taken possession of consciousness, as it were, in its own right; there has been no resistance to the intruding ideas. The unpleasant event has appealed as strongly and irresistibly to the attention as would a loud sound or the perception of movement in the visual field (see **ATTENTION**); in other words, the news consciousness is in a state of passive attention. Furthermore (as we have all along implied), the news is keenly and deeply felt; the assimilation, which reflects in idea the total situation that our imagined individual has to face, is washed over, colored, perhaps almost swamped, by affective processes. Finally—and this is suggested by the phrase "face the situation"—the emotion finds expression (q.v.) in certain bodily movements or attitudes; the disagreeable news may be "met" by a shrinking and cowering attitude, by a sour or bitter facial expression, perhaps by the effusion of tears or sweat; or, again, by a brace and set of the muscles and a frown of resolution. In both instances the bodily response evokes certain intensive organic sensations. These attach to the ideational elements of the central assimilation and materially enrich its contents; while their high affective value gives them a prominent part in the total "feel" of the emotion. In sum, then, an emotion arises when (1) the current train of thought is interrupted by (2) an assimilation, which represents some situation or incident in

our social or professional world. The assimilation (3) holds the passive attention and is (4) keenly felt. Moreover, the representative contents and the affective coloring of consciousness are both enhanced by (5) a complex of organic sensations, the result of the way in which the situation as a whole takes the situation in itself involved. It follows from this extreme complication of component processes that the emotion occupies a fairly long period of time, has a distinct temporal course. We should say, indeed, speaking from unanalyzed experience, that joy and sorrow, hope and fear, may dominate consciousness, not only for hours, but for days, and sometimes, with intermissions, for weeks and months; while the consequent mood or disposition may continue for years. Such a statement would miss the finer ideational trend, and the frequent of foreign consciousnesses that introspection reveals. Nevertheless, the persistence of the emotion in time, its ripening, maturing, and gradual decay, are so characteristic that Wundt gives it a temporal definition. An emotion, he says, is "a series of feelings, succeeding one another in time, which unite to form an interconnected process that is distinguished, as an individual whole, from preceding and following processes." It follows, further, from the facts of emotive "expression" that there is an intimate relation between emotion and will. Emotion differs from volition only in the point that it fades out or subsides when its course is over, to make way for customary trains of thought and habits of action; while the volition, beginning as does the emotion, ends in "a sudden change of sensational and affective contents, which brings the emotion to an instantaneous close"—i.e., in a voluntary action. See ACTION; WILL.

There is, however, another view of the nature of emotion—the James-Lange theory, as it is called—which must be noticed here. Simply stated, the theory is that emotion consists essentially of organic sensations. "The bodily changes follow directly the perception of the exciting fact," wrote James in 1890, "and our feeling of the same changes as they occur is the emotion. . . . The more rational statement is that we feel sorry because we cry, angry because we strike, afraid because we tremble, and not that we cry, strike, or tremble because we are sorry, angry, or fearful." The hypothesis rests upon three principal arguments. (1) There can be no doubt that "objects" do "excite bodily changes by a preorganized mechanism," and that "these changes are so indefinitely numerous and so varied that the entire organism may be called a sounding board" for changes in consciousness. (2) "Every one of the bodily changes . . . is felt acutely or obscurely, the moment it occurs." (3) "If we fancy some strong emotion, and then try to abstract from our consciousness of it all the feeling of its bodily symptoms, we find we have nothing left behind." In a later article (1894) James explains that by "exciting object" he means the total situation; the object as accompanied by its associated train of ideas and tinged with agreeableness or disagreeableness. The theory then asserts merely that the "rank feeling of excitement," characteristic of emotion, is mediated by the organic sensations aroused by our instinctive reaction upon the situation. Even in this form, however, it can hardly be accepted.

As regards the three points suggested above, those who are opposed to the James-Lange point out that the statement in (1) is certainly exaggerated, while that in (2) is untrue; by no means every bodily change is felt. As to (3), the organic sensations may be invariable concomitants, ingredients, or effects of emotion; they need not, however, be on that account its essential constituents. Appeal is made by the defenders of the theory to two classes of facts. (a) In pathological cases, where there is far-reaching organic anæsthesia, there is also entire or approximate absence of emotion. The opponents reply that such anæsthesia is found only where there is also found a very great weakness of the life of idea and judgment. We should therefore expect, on any theory, to find a corresponding weakening of emotion; the appeal is altogether irrelevant. (b) Emotions may be set up by purely ideational means (by the action of drugs) in which ideas and judgments play no part at all. Palpitation of the heart and feelings of suffocation produce fear; a certain amount of alcohol produces exhilaration and cheerfulness. But, it may be replied, the palpitation and suffocation are not in themselves terrifying; they terrify because they suggest the idea of death, and the quickening of the blood circulation and thrills of pleasant warmth that follow the taking of alcohol are not in themselves exhilaration; they bring with them a change in the current of ideation and an altered estimate of new-coming impressions; and it is here, in the changed situation, that we must look for the condition of the cheerful emotion. It is clear, then, that "the road to emotion lies always through the line of ideas" (Stumpf). Moreover, it is pointed out that positive arguments against the theory are at hand. (a) If the "rank feeling of excitement" is constituted of organic sensations, how is it that we are familiar with sensations as such; that we can describe them, isolate them by analysis, gauge their intensity, localize them? The sensation of nausea or of strain may be discussed as sensation, pure and simple. Under what circumstances does it lose its sense identity and become a "feeling of excitement"? The theory speaks of an "instinctive" reaction, and of bodily changes following "directly" upon the exciting fact. But it brings no evidence to show that this reflex or instinctive mode of arousal can change a sensation into a feeling of excitement. (b) If the organic sensations are of the essence of emotion, then the emotive consciousness should evince definite changes in intensity, quality, and temporal course, according as the organic sensations change in these respects. It does not, for we may have an intensive emotion without marked peripheral reactions; while, e.g., rage and extreme joy closely resemble each other in their bodily "expression," but are by no means alike in experience.

But those who cannot accept the James-Lange theory as an adequate account of the emotive process, nevertheless grant that its formulation has been, and may yet be, useful in various ways. It lays emphasis upon certain components of emotion that are too often overlooked, and so increases the accuracy of our descriptions; it warns us against an undue intellectualism, an overestimation of idea as compared with bare sentience; and it suggests a means of settling,

or at least . . . the old and vexed question of . . . of the emotions. If we could make a list of the typical situations which the adult man is called upon to face, and could tabulate in detail the bodily sets and braces, the quivers and chokings wherewith he faces them, we should gain, not a new basis of classification, for that would imply acceptance of the theory, but, at any rate, a valuable group of facts to assist us in classification. As for the attempts that have already been made, their name is legion. Emotions have been classed "as sad or joyous, sthenic or asthenic, natural or acquired, inspired by animate or inanimate things, formal or material, sensuous or ideal, direct or reflective, egoistic or nonegoistic, retrospective, prospective, or immediate, organismally or environmentally initiated" (James). It is clear that many of these divisions rest upon a nonpsychological (i.e., upon a biological, logical, or ethical) basis and must therefore be rejected by psychology. The best mode of classification at the present time is perhaps that which distinguishes primarily between *qualitative* emotions, conditioned upon the quality or character of the emotive situation, and *temporal* emotions, conditioned upon the temporal aspects of the stimuli composing the situation. Joy and sorrow, like and dislike, are emotions of quality; hope and fear, and pleasant and unpleasant surprise, are emotions of time. Within each of these main groups we may further distinguish between objective and subjective forms of a given emotion—the former characterized by emphasis upon the objective situation, the latter by emphasis upon our subjective attitude to it. Thus, joy and sorrow are subjective, while like and dislike, sympathy and antipathy, attraction and repulsion, are objective. Finally, we may mark off various degrees of intensity of a typical emotion, as melancholy and wretchedness, or friendliness, affection, and love.

**Bibliography.** James, *Principles of Psychology* (New York, 1890); Wundt, *Outlines of Psychology*, trans. by Judd (Leipzig, 1902); *Human and Animal Psychology*, trans. by Creighton and Titchener (London, 1901); Lange, *Ueber Gemüthsbevegungen* (Leipzig, 1887); Titchener, *Text-Book of Psychology* (New York, 1910). See AFFECTION; ANGER; FEAR; FEELING; MOOD; SENTIMENT.

**EMPANEL, or IMPANEL.** To place names of jurors on a list. Formerly a little pane or oblong piece of pavement was used for this purpose, and the list is still called a panel (q.v.). In . . . the term is applied generally to the : . . . sheriff in making the list of jurors who have been summoned for a designated term of court. While used in this sense in the United States, it is more frequently employed to denote the selection of a jury for the trial of a particular case. Thus, a jury is said to be impaneled when its membership has been determined and it has been sworn to try the case. Consult the authorities referred to under JURY.

**EMPECINADO**, ém-pā'thē-nā'dō, DON JUAN MARTÍN DÍAZ, EL (1775-1825). A Spanish patriot, a leader of guerrillas. He was born at Castrillo de Duero, in the Province of Valladolid, and at the age of 17 joined the army. At the head of 5000 or 6000 men he carried on a fierce and successful warfare against the French during the Peninsular struggle. In 1814 he was appointed colonel in the regular army, and the King himself created him field

marshal; but in consequence of his petitioning Ferdinand VII in 1815 to reinstitute the Cortes, he was imprisoned and afterward banished to Valladolid. On the outbreak of the insurrection in 1820 he took a prominent part on the side of the Constitutionalists and on several occasions exhibited great courage. He was taken prisoner in 1823 and, on the restoration of Ferdinand, El Empecinado was exposed in an iron cage, and after a miserable imprisonment of two years was sentenced to be hanged. Resisting his executioners, he was stabbed to death. The name El Empecinado, by which this guerrilla hero was popularly known, was a nickname, meaning "the man covered with pitch." It is the name given by natives of other villages to natives of Castrillo, because near Castrillo there are two streams that form a black mud called by the natives *pecina*. At the request of Juan Martín Díaz, a royal cedula declared *el Empecinado* to be the patronymic of the family.

**EMPEDOCLES** (Lat., from Gk. Ἐμπεδοκλῆς, *Empedoklēs*). A Greek philosopher, of the fifth century B.C. He was born of a distinguished family at Agrigentum in Sicily and was held in high esteem by his fellow citizens for his skill in medicine and rhetoric as well as for his ability as a philosopher. He used his influence to help establish a democracy in his native city. After his death marvelous tales were current of his powers as a magician which, tradition said, enabled him to turn away pestilential winds, to recall to life a girl thought to have been long dead because in a trance, and to perform similar miracles. Indeed, it would seem from his own verses, preserved by Diogenes Laërtius (q.v.), 8, 62, that he claimed to be immortal and accepted as his right all the honors shown him by his contemporaries. Of his death various traditions were current in later antiquity. The most familiar of these said that he leaped into the crater of Etna (consult Matthew Arnold's *Empedocles on Etna*); another that he was translated while his companions slept; but a third said that he died a natural death in the Peloponnesus. Empedocles was possessed of considerable poetic gifts and left behind him two poems—one on Nature (*Περὶ Φύσεως*), which set forth his theory of the universe; in the other, entitled *Kathappol*, of ethical import, he exhorted his fellow citizens to lives of purity. In this latter poem he seems to have adopted the Pythagorean doctrine that some souls at least, to be purified, must migrate through many bodies. Of the former poem about 400 verses, of the latter about 100, have survived.

In philosophy Empedocles was an eclectic, attempting a combination of the teachings of the Eleatic school (q.v.) as to "being" with Heraclitus' doctrine of "becoming." Following the teaching of the Eleatics as to "being" as eternal and imperishable, he assumed four elements—earth, air, fire, and water—mutually indervative, independent principles, which, however, are capable of being divided. That these four elements differ qualitatively, and therefore cannot consist of pure being, was a difficulty which did not occur to him. To account for the changing phenomena of the visible world, he employed the principle of "becoming" enunciated by Heraclitus (q.v.), but postulated as the two primal dynamic causes of change, "Friendship" (*φιλότης*) and "Strife" (*νεῖκος*), of which the first is the uniting, the second the separating, principle; these primal powers or forces he thought of as

divine. The two powers always existed coincidentally; now one, now the other was in the ascendant. In the beginning, according to Empedocles, the four elements existed together immovable in the Sphere (*σφαῖρος*), the perfect primitive world, where they were maintained by Friendship, until Strife, which originally was outside, gradually made its way into the Sphere and separated the elements and gave rise to individual and contrary phenomena. The two principles, Friendship and Strife, by action and interaction produce constant change, and ultimately the world must again return to its original unity, only to give birth to a new system, and so on indefinitely. By attributing to his four elements immutable being, so that they cannot arise out of one another or be changed one into another, Empedocles made an advance over the early Physicists, and by recognizing in contrast to the Eleatics that change actually exists, and by . . . causes, he places in a new light . . . between matter and its informing principles. On many points Empedocles' views are not clear; but his theory of knowledge is of especial interest, for he was the first to state clearly the doctrine that like is known by like, i.e., that the mind perceives only that which is by nature cognate or analogous to it, that we ourselves are composed of the same elements which make up all things of which we can have any knowledge.

Empedocles was greatly admired in antiquity, especially by Aristotle and Lucretius (q.v.). The latter chose him as his model, although he criticized his philosophy. The fragments of Empedocles' work have been published by Mullach, *Fragmenta Philosophorum Græcorum*, vol. i (Paris, 1860); Ritter and Preller, *Historia Philosophiæ Græcæ* (9th ed., Gotha, 1913); Diels, *Die Fragmenta der Vorsokratiker* (3d ed., 1912). A translation into verse was made by Leonard (1908). Consult also: Gladisch, *Empedokles und die Aegypter* (Leipzig, 1858); Lommatsch, *Die Weisheit des Empedokles*, etc. (Berlin, 1830); Ritter, *Ueber die philosophische Lehre des Empedokles* (ib., 1820); Baltzer, *Empedokles* (Leipzig, 1879); Zeller, *Philosophie der Griechen*, vol. i (ib., 1881); Ueberweg, *History of Philosophy*, vol. i (trans., New York, 1872); Erdmann, *History of Philosophy*, vol. i (trans., London, 1889); Bidez, *La biographie d'Empédocle* (Ghent, 1894); *North British Review*, vol. xlv (Edinburgh, 1888); Fairbanks, *The First Philosophers of Greece* (New York, 1898); Gomperz, *Greek Thinkers*, vol. i (ib., 1905); Bakewell, *Source Book in Ancient Philosophy* (ib., 1907); Masson, *Lucretius, Epicurean and Poet* (New York, 1907-09); Clara E. Miller, *On the Interpretation of Empedocles* (Chicago, 1908); Adam, *The Religious Teachers of Greece* (Edinburgh, 1909); Windelband, *Geschichte der griechischen Philosophie* (3d ed., Munich, 1912).

**EMPEDOCLES ON ETNA.** A poem by Matthew Arnold, best described as a dramatic monologue, interspersed with songs after the manner of the Greek chorus. It appeared in 1867.

**EMPEROR** (OF. *empeireor*, Lat. *imperator*, Olat. *induperator*, from *imperare*, to command). The original signification of this, which in the modern world has become the highest title of sovereignty, can be understood only when it is taken in conjunction with *imperium* (q.v.), which in the Roman political system had a peculiar and somewhat technical meaning. The

*imperium* of a magistrate was the power which he possessed of bringing physical force into operation for the fulfillment of his behests. The term was specially applied to the military authority exercised by a magistrate in command of an army away from Rome. The name "imperator" thus came to denote in particular a commander of troops; after a victory such a commander was specially hailed by his army as imperator. The *imperium* was conferred by a *lex curiata*, and it required this authorization to entitle a consul to act as the commander of an army. In the case of the kings, also, the *imperium* was not implied in their election, but was conferred separately, by a specific act of the national will. Now, it was in virtue of this *imperium* that the title "imperator" was given to its possessor. Far from being an emperor in the modern sense, he might be a consul or a proconsul; and there were, in fact, many *imperatores*, even after the title had been assumed as a *prænomen* by Julius Cæsar (58-44 B.C.). It was this assumption by Julius Cæsar which gradually gave to the title its modern signification. In republican times it had followed the name (see *NOMEN*), and indicated simply that its possessor was an imperator, or one possessed of the *imperium*; now it preceded it, and signified that he who arrogated it to himself was the emperor. In this form it appears on the coins of the successors of Julius. After the times of the Antonines the title grew into use as expressing the possessor of the sovereignty of the Roman world, in which sense *princeps* also was frequently employed. Consult: Schuckburgh's edition of the *Augustus of Suetonius*, pp. xix-xxviii (Cambridge, 1896); Jones, *The Roman Empire* (New York, 1908); and the articles "Imperium and Imperator" and "Princeps," in Smith, *A Dictionary of Greek and Roman Antiquities* (2 vols., 3d ed., London, 1890-91).

The title "emperor" was used by the rulers of the Byzantine realm down to its extinction in 1453. From the emperors of the West the title passed to Charlemagne, the founder of the German Empire. When the Carolingian family expired in the German branch, the Imperial crown became elective, and continued to be so till the Holy Roman Empire came to an end—Francis II, who in 1804 had declared himself hereditary Emperor of Austria, . . . laid it down in 1806. In addition to . . . of Austria there are in Europe the Emperor of Russia and Emperor of Germany. In 1876 the Queen of India . . . assumed the title of Empress of India, . . . to those which she bore previously; the King of England is now Emperor of India. See *EMPIRE*.

**EMPEROR BOA.** See *BOA*.

**EMPEROR BUTTERFLY and MOTH.**

1. A group of butterflies of the southern United States. The best-known species is the goatweed butterfly (*Pyrrhanæa andria*), dark brown and orange in colors, which occurs from Illinois to Texas, the larvæ of which feed on the goatweed (Croton). 2. A large British moth (*Saturnia pavo-minor*) of the family Saturniidae, about 2½ inches across the expanded wings, which are gray in the female and in the male are reddish brown on the fore wings and rusty yellow on the hinder wings; each wing is ornamented with a large, eyelike, glassy, and transparent spot. It is the largest British moth, but is much exceeded in size by the congeneric peacock moth (*Saturnia pavo-major*) of the continent

of Europe and Asia. Both are closely allied to the silkworm.

**EMPEROR FISH.** One of the largest and most gaudy of the coral fishes (q.v.), characteristic of the genus *Holacanthus*, which differs from other chaetodonts in having the gill cover armed with a stout, backward-pointing spine. The emperor fish (*Holacanthus imperator*) is found from East Africa to Malaya, reaches a length of 15 inches, and is deep blue, marked with many golden-yellow stripes running from head to tail, while the head is richly ornamented with black and gold. Hence the name "emperor of Japan," applied by the Dutch of the East Indies, seems appropriate. Its flesh is regarded as superior to that of almost any other East Indian fish, resembling salmon. This genus contains some 40 species, widely distributed in tropical seas, some of which, as the large, beautiful, and toothsome isabelita, or angel fish (*Holacanthus ciliaris*) and the black angel fish (*Holacanthus tricolor*), illustrated on the Plate of CORAL FISHES (q.v.), frequent the coral reefs of Florida, Bermuda, and the West Indies, and occasionally stray northward.

**EMPE/STRUM.** See CROWBERRY.

**EM/PHASIS.** See ACCENT.

**EMPHYSE/MA** (Neo-Lat., from Gk. ἐμφύσημα, inflation, from ἐν, *en*, in + φυσᾶν, *physan*, to blow). An unnatural distention of a part with air. It is rarely that emphysema is produced otherwise than mechanically; but collections of fluid in a state of decomposition sometimes give out gases which penetrate and distend the textures with which they are in contact. A form of emphysema attended by gangrene occurs as a result of microbic infection.

Emphysema of the lung is a condition in which the partitions between the air cells or vesicles are ruptured and absorbed, thus throwing numerous small cavities into one. The result is diminished elasticity of the lung tissue and deficient expansion of the organs. It is generally due to long-continued strain, as in using wind instruments, or to chronic bronchitis, or as a phenomenon of old age.

**EMPHYTEU/SIS** (Lat., from Gk. ἐμφυτεύσις, an implanting, from ἐμφυτεύειν, *emphyteuein*, to implant, from ἐμφύτος, *emphytos*, implanted, from ἐμφύειν, *emphyein*, to implant, from ἐν, *en*, in + φύειν, *phyein*, to plant). At Roman law, a perpetual, alienable, and heritable right of possession of land enjoying agricultural property in return for the payment of an annual ground rent. This institution, as it is found in the laws of Justinian, had two roots. 1. In Italy, during the period of the Roman Republic, assignments of lands belonging to the Roman people or to a municipality were made to private persons, nominally at the pleasure of the Roman people or of the municipality, but practically on an indefinite, alienable, and heritable tenure; and for the use of these lands a fixed payment (*vectigal*) was made. Lands so held were termed *agri vectigales*. 2. In the eastern provinces of the Roman Empire tracts of unimproved land were granted, on a perpetual tenure, for improvement or "plantation" (*emphyteusis*), in consideration of a fixed annual ground rent (*canon*), which was regularly based on the value of the unimproved property; and such grants were not infrequently made by private proprietors. When the Empire became Christian, such grants were made also by churches and monasteries.

Neither of these institutions, *ius in agro vectigali* or *emphyteusis*, could be brought under the Roman law of lease (*locatio conductio*), because the Roman lessee had no protection against third persons except through his lessor, and no protection against his lessor except, in case of breach of contract, by action for damages; while the holder of an *emphyteusis* was protected against his landlord, and the holders of *ius in agro vectigali* or of *emphyteusis* enjoyed the same rights of action against third persons as if they were owners. Both therefore had, what the Roman lessee had not, a right in the land itself. These two institutions were fused by Justinian into one. As against the landlord, the emphyteutist had the right of possession and enjoyment, under the following limitations: he must keep the land in cultivation; he must pay the taxes on the land; he must pay the annual ground rent to his landlord; and, if he proposed to sell his right, he must inform the landlord of his intention and of the price offered. The landlord had then the right either to buy the *emphyteusis* himself at the same price or to exact 2 per cent of the price. The landlord had the right of reentry upon the land when it was sensibly deteriorated by neglect or misuse, when taxes or ground rent had not been paid for three years, when notice of intention to sell was not given, or when the price offered was not truthfully stated. Teutonic law developed a similar institution, known as heritable leasehold (*erbpacht*).

Mediæval jurists were inclined to construe both *emphyteusis* and *erbpacht* as a divided ownership, attributing titular ownership to the landlord and beneficial ownership to the occupant. (See DOMINIUM.) The revolutionists of the eighteenth and nineteenth centuries disliked these perpetual leaseholds as savoring of feudalism; and in many states the ground rents were either abolished or provision was made for their redemption. In some European states, however, the institution survives, sometimes under the name of *erbpacht*, sometimes under that of *emphyteusis*, with more or less blending of Roman and mediæval rules. See CENSO; SUPERFICIES; CIVIL LAW; and compare the analogous doctrines of English and American law under the titles LEASEHOLD; RENT (*Rent Service*, *Rent Charge*); FEUDAL TENURE.

**EM/PIRE** (OF., Fr. *empire*, from Lat. *imperium*, power, from *imperare*, to command). The territory and people whose sovereign bears the title of emperor or empress—a title which, since the time of Julius Cæsar, has come to imply the possession of monarchical power in its highest form. (See IMPERIUM.) The Roman Empire, from 395 A.D., was divided into two parts—one of which was ruled from Rome, the other from Constantinople. The Empire of the West succumbed to the onslaught of the Germanic nations in 476, while the Eastern, or Byzantine, Empire survived until 1453. Charles the Great, King of the Franks, was crowned Emperor at Rome by Pope Leo III in 800. Thus the Empire of the West was nominally revived, and the title of Emperor of the Romans continued to be borne by his successors for nearly a century. About 50 years after the extinction of the Carolingian dynasty in Germany, the German King, Otto the Great, after conquering the Lombards, had himself crowned Emperor by the Pope at Rome in 962, from which year dates the Holy Roman Empire of the German

nation, frequently spoken of simply as the "Empire." From Otto's time, with the exception of the short period of the Interregnum in the thirteenth century, there was an unbroken succession of elected German kings, who assumed the rank and right of emperors and were acknowledged as such by the church. The Holy Roman Empire came to an end in 1806, after its last ruler had assumed the title of Emperor of Austria. In 1871 the German states, with the exclusion of Austria, were constituted an empire, the dignity of German Emperor being made hereditary in the royal dynasty of Prussia. In addition to the three empires of Christendom—Germany, Austria-Hungary, and Russia—the Turkish, Japanese, and Abyssinian realms are spoken of as empires, while the King of England bears the title of Emperor of India. Previous to 1889 Brazil was an empire. See EMPEROR; HOLY ROMAN EMPIRE; GERMANY.

**EMPIRE, ROMAN.** See EMPEROR; EMPIRE.

**EMPIRE STATE.** New York. See STATES, POPULAR NAMES OF.

**EMPIRIC** (Lat. *empiricus*, Gk. *ἐμπειρικός*, *empeirikos*, empire, from *ἐμπεiros*, *empeiros*, skilled in, from *ἐν*, *en*, in + *πείρα*, *peira*, trial). The name applied to a sect of ancient physicians in the time of Celsus and Galen. They laid great stress on the unprejudiced observation of nature, and thought that, by a careful collection of observed facts forming a history, the coincidence of many observations would lead to unalterable prescriptions for certain cases. The later adherents of the school excluded all theoretical study, even that of anatomy, and were guided solely by tradition and their individual experience. By an empiric in medicine is now understood a man who, from want of theoretical knowledge, prescribes remedies by guess according to the name of the disease or to individual symptoms, without knowledge of the pathological conditions, the chemical changes occurring, or the individuality of the patient; in other words, a quack. Many so-called "specific medicines" are administered on this principle, or want of principle.

**EMPIRICISM** (Gk. *ἐμπειρία*, *empeiria*, experience, from *ἐμπεiros*, *empeiros*, skilled in). The philosophical view that experience is the source of all knowledge. Until recently the term "empiricism" has been applied to the view held mainly by English writers of the seventeenth, eighteenth, and nineteenth centuries. John Locke was the first to give it systematic expression, but Francis Bacon before him was in temper an empiricist. Classical English empiricism can be succinctly stated as follows, although not every early English empiricist is to be considered as subscribing to what may be called this standardized empiricism. This empiricism denies the existence of any *a priori* (q.v.) constituents in knowledge, maintaining that at first the mind is a *tabula rasa*, or clean slate, upon which experience must inscribe all the characters. These inscriptions come one by one, and what seems to be a necessary connection appears so only from the habit we have formed of associating certain elements together. Even in antiquity there were thinkers with distinctly empiricist proclivities, as, e.g., the Sophists (q.v.). (See LOCKE; HUME; MILL, JAMES; MILL, JOHN STUART.) The fault of this classical English empiricism is not that it traces all knowledge back to experience, but that it gives a wrong account of experience, representing it

as a piecemeal affair, an aggregation of psychological elements with an accidental structure. Opposed to this empiricism stood the continental rationalism (q.v.) represented by such philosophers as Descartes, Spinoza, Leibnitz, and Wolff, who championed the ability of the mind to know reality by means of its faculty of reasoning, which was for them independent of experience. Kant attempted a compromise between empiricism and rationalism, restricting knowledge to the domain of experience (thus agreeing with the empiricists) but attributing to the mind a constructive function, in building the raw materials of sensations into the systematic structure of experience. This structure can be known *a priori*, without resorting to empirical methods. (In this respect Kant agreed with the rationalists.)

In recent years the term "empiricism" has taken on a more flexible meaning, being now used quite frequently of any philosophical system which finds all its materials in experience, even when experience is not considered as atomic in constitution, i.e., as an accidental collection of psychic elements. William James thus called his own philosophy "radical empiricism," distinguishing it from traditional empiricism by the fact that the latter "has always shown a tendency to do away with the connections of things and to insist most on the disjunctions," while his own empiricism "does full justice to conjunctive relations, without, however, treating them as rationalism always tends to treat them, as being true in some supernatural way, as if the unity of things and their variety belonged to different orders of truth and validity altogether." This radical empiricism holds "that the relations between things, conjunctive as well as disjunctive, are just as much matters of direct particular experience, neither more so nor less so, than the things themselves." The world is composed of experiences, each connected by some experienced relation with some other experience. Time and space are common media in which these constituent experiences lie, but there is no one consciousness in which the whole is included.

John Dewey has also contributed to a more liberal construction of empiricism, calling his own view an "immediate empiricism," which "postulates that things—anything, everything, in the ordinary or nontechnical use of the term 'thing'—are what they are experienced as. Hence, if one wishes to describe anything truly, his task is to tell what it is experienced as being." Knowledge is itself a form of experience and must be treated descriptively as it is found: "go to experience and see what the thing is experienced as." Immediate empiricism is thus a method, the empirical method universally applied. For the traditional empiricism, consult: Green, *Prolegomena to Ethics* (5th ed., Oxford, 1884); Pfeiderer, *Empirismus und Skepsis in Dav. Hume's Philosophie* (Berlin, 1874); and the histories of philosophy by Windelband, Höfding, Ueberweg, Erdmann, Fischer, Falckenberg. For the more recent empiricisms, consult: James, *The Meaning of Truth* (New York, 1909); *Essays in Radical Empiricism* (ib., 1912); *Pluralistic Universe* (ib., 1909); *Some Problems of Philosophy* (ib., 1911); Dewey, *Influence of Darwin on Philosophy* (ib., 1910).

**EMPIS**, ἄν' ἑ, ADOLPHE DOMINIQUE FLORENT JOSEPH SIMONIS (1795–1868). A French dramatist, born in Paris. From 1856 to 1859 he



was administrator of the Théâtre Français. He is the author of a number of plays which have been praised for their natural style, their dramatic situations, and their fine study of character. These productions include: *Bothwell* (1824); *La mère et la fille*, with Mazères (1830); *Un changement de ministère* (1831); *Un jeune ménage* (1838); *L'Héritière* (1844); *Les six femmes de Henri VIII* (2 vols., 1854).

**EMPLOYERS' LIABILITY.** In general, the liability of employers for injuries sustained by workmen while in their employ. (See NEGLIGENCE; TORT.) Specifically the expression is most frequently employed to describe certain statutes, recently enacted in England and the United States, with the object of defining and enlarging this common-law liability.

A person being generally liable, not only for his own direct acts of negligence, but indirectly for those of his servants as well, it might be supposed that an employee injured in consequence of such negligence, either on the part of his employer or of a fellow employee, would be entitled to recover damages from his employer for the injury so sustained. But the nature of the relation of master and servant at common law, and the conditions of service formerly existing, have led to a peculiar rule limiting the liability of employers to their employees as distinguished from other persons exposed to injury from the manner in which the business is carried on. This rule is to the effect that an employee, on entering upon his service, implicitly engages with his employer to run all the ordinary risks of the service, including the risk of negligence on the part of his fellow servants. The employer is, of course, liable for gross negligence, and for novel and extraordinary risks involved in the service, as well as for all acts of negligence, whether of the master or of fellow servants, occurring outside the regular service; he is bound to use due diligence in selecting his superintendents, foremen, and other servant, to furnish them with suitable appliances and a safe and proper place in which to carry on their work and to make necessary rules. It makes no difference whether the negligent fellow servant through whose fault an injury is sustained is a foreman, whose orders the injured servant was bound to obey, or a fellow servant in the ordinary sense, working side by side with the injured man. The "risk" voluntarily assumed by the man who enters another's employ covers "all persons engaged under the same employer for the purposes of the same business, however different in detail those purposes may be."

With the change in the relations of employer and employee, due to the transformation of industrial conditions in recent years, these rules of the common law have taken on a harsh and arbitrary aspect, which under older conditions they did not present. They have accordingly been modified by legislation, both in England and in the United States. The earliest statute of this sort was the Employers' Liability Act, passed by Parliament in 1880 (43 and 44 Vict., c. 42), with the avowed object of extending and regulating the liability of employers to make compensation for personal injuries suffered by workmen in their service. It exempted workmen from the common-law doctrine when injury was due to defective work or machinery, putting them in much the same position with respect to their employer as that occupied by an out-

sider, and by excluding from the definition of fellow servants foremen and others exercising authority over the injured employee, making the employer liable for the acts of those exercising a delegated authority under him. It also abolished the immunity of persons and corporations operating railroads in all cases of injury suffered by railroad employees in consequence of collisions and other railroad accidents. This statute was followed in 1897 and 1900 by the Workmen's Compensation Acts (60 and 61 Vict., c. 37, and 63 and 64 Vict., c. 22), which in certain large classes of employment, as railways, factories, mines, etc., render the employer liable for any personal injury incurred by a workman by any accident arising out of and in the course of his employment, whether due to the fault of the employer or not; and these acts were in 1907 superseded by the Workmen's Compensation Act, 1906 (6 Edw. vii, c. 58), which removes the restriction of the principle to special classes of employment and makes it of nearly universal application. Under this legislation the employer is virtually an insurer of all persons in his employ against all injuries sustained in the course of their employment, paying a limited compensation to those injured or to the families of those killed by such accidents, whether or not due to want of care on his part or that of his servants.

The American legislation on this subject is of a very diverse character, most of the States having passed statutes enlarging the liability of the employer of labor. In some States this liability has been confined to employees of railroad companies; and in some the disposition to evade the new rule of liability, by requiring an employee to sign a contract waiving the benefits of such legislation, has been defeated by further statutes forbidding the making of such contracts or declaring them to be null and void. The English Act of 1906 has been followed in several States, including New York, New Jersey, Massachusetts, Wisconsin, and others, and by an act of Congress applying to persons engaged in interstate commerce.

The constitutionality of this legislation has been questioned on the ground that, where the employer was free from fault, the provision of compensation to the employee was a taking of property not for a public purpose and without due process of law. In 1911 the New York Court of Appeals declared the Workmen's Compensation Act of that State unconstitutional and void on that ground. This decision was very unpopular and was severely criticized by a large section of the bar as well as by the public, and furnished one of the principal grounds for the proposal, embodied in the Progressive platform of 1912, for the so-called "recall of judicial decisions" by popular vote. In 1913 the New York constitution was amended so as to permit legislation of this character. Substantially similar acts have recently (1913-14) been sustained as constitutional by the Supreme Court of Wisconsin and the Supreme Court of the United States.

The extension of employers' liability by the legislation above described has led to the institution of a novel kind of insurance, known as employer's liability insurance, whereby the employer is insured against loss by reason of his liability to his employees; the insurer, in consideration of a premium paid by the employer, agreeing to pay all damages with which the lat-

ter is or for which he may become legally liable. Recent employers' liability acts make such insurance compulsory and in some States the State itself provides such insurance.

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**EMPLOYERS' LIABILITY INSURANCE.** See INSURANCE; ACCIDENTS, INDUSTRIAL.

**EMPLOYMENT BUREAU.** Any agency intended to bring employers and the unemployed together. There are four kinds: (1) private trade-unions for skilled labor; (2) labor societies; and (3) free bureaus established by national or local governments. The free bureaus have in view the larger object of adjusting the entire labor market. The fullest expression of this method has been found in France, where in 1851 a comprehensive scheme for the establishment of employment bureaus throughout the country was submitted to the Legislative Assembly. The measure failed of adoption; but the idea was persistently agitated until Oct. 7, 1888, when the Bourse de Travail was opened in Paris with a subsidy of 150,000 francs from the government. A large building was erected in 1892 which became the headquarters of labor syndicates. Owing to a dispute between the labor syndicates and the administration, it was closed July 6, 1893. It was reopened in 1896, and is at present under the management of a commission chosen in part by the labor syndicates, in part by the administration. There are also throughout France numerous bureaus managed by unions of labor syndicates. These ordinarily seek to place members of syndicates—or unions—alone, though they may extend their assistance to other workmen with the hope of inducing them to join the syndicates. A national bureau has been established with the purpose of supplying the supply of labor in different parts of the country. This bureau received in 1900 an appropriation from the state; but since it was founded to employ its influence to keep workers away from districts where strikes are in progress, government aid has been withdrawn from it. Public bureaus have been opened in 49 other cities. In 1870 the system was established in Belgium with good results. In England the movement began with the Egham bureau, established in 1885, and discontinued after the passing of the Local Government Act in 1894. Another voluntary bureau was established in Ipswich in 1885 and operated until 1906, when its work was taken over by the Distress Committee. Several municipal bureaus were established in the depression of 1892. Official inquiry in 1905 disclosed the existence of 21 municipal and three nonmunicipal bureaus. Few of the bureaus showed any considerable degree of activity, and their work was taken over by Distress Committees under the local governments, which attempted—with no very brilliant success, as a rule—to meet the

need of organization of the labor market. By Act of 1909 the establishment of employment bureaus, or labor exchanges, was made compulsory throughout the United Kingdom. Under this act 423 labor exchanges had been established by 1914, with 1066 local agencies, each directed by the nearest exchange. The system is controlled by a central office in London, with eight divisional offices in various cities. The system has been successful in organizing the market for casual and unskilled labor. Switzerland has offices at Bern and Basel, and since 1889 several Italian cities have started labor exchanges, the most important being at Milan. In Germany the movement is recent, but extensive. In addition to the official bureaus there exist employers' unions and joint associations of employers and trade-unions. The first municipal bureau grew out of such an association started in Frankfurt in 1892. Bureaus organized by municipalities have been especially successful in southern Germany. The best system is that of Munich, with an elective board of employees and employers, having a city officer as chairman. In its first year of full operation (1896) the Munich bureau found situations for 25,586 persons, and its work has rapidly increased in effectiveness. At present there is a municipal labor bureau in almost every German city of over 50,000 inhabitants and in many of the lesser cities as well. In north Germany the voluntary association, subsidized by the municipality, performs much of the work conducted in south Germany by purely municipal agencies. There is a considerable degree of coöperation among the agencies of the several municipalities to the end of organizing a national labor market. In the United States the private agencies play an important part in adjusting the conditions of the labor market. Since it is usually laborers of the lowest and most ignorant classes who are compelled to make use of an agency for finding employment, it has been easy for unscrupulous parties to secure great profits through the establishment of fraudulent bureaus. A number of States have attempted to meet this evil by requiring the licensing of private employment bureaus or the furnishing of bonds. In other States public labor bureaus have been established with the hope of destroying private agencies altogether. Ohio, as the pioneer by the Law of April 28, 1890, started bureaus in five cities. State laws providing for public employment bureaus were in force in 18 States in 1914. Most of these bureaus are under the management of the labor departments of the respective States and, through lack of adequate machinery, accomplish practically nothing. The most successful law is that of Wisconsin, giving to the Industrial Commission, created in 1911, broad powers to organize and conduct employment bureaus. A competent staff was chosen to establish an employment bureau at Milwaukee in 1912. In its first year of operation the bureau secured positions for 11,400 applicants, and its second year of operation showed an increase of 40 per cent in work done. Three other bureaus have been opened in other cities. The philanthropic agencies are the charity organizations, Young Men's Christian Associations, churches, settlements, and the Salvation Army. In recent years, owing to the publications of investigations revealing the iniquities of the private agencies, a number of semiphilanthropic agencies have been established by employers. Consult:

*Quarterly Journal of Economics*, vol. xiv (Boston, 1900) (notes give reference to State Bureau of Labor Reports and Foreign Reports); Kellor, *Out of Work* (New York, 1904); Beveridge, *Unemployment* (London, 1909); Bramstedt, *Das Problem der Beschaffung von Arbeit durch Stadt und Gemeinde* (Kiel, 1909); Leiserson, "Public Employment Offices," *Political Science Quarterly* (March, 1914). See CHARITY ORGANIZATION SOCIETY; LABOR EXCHANGES; UNEMPLOYMENT.

**EMPLOYMENT DISEASES.** See OCCUPATIONAL DISEASES.

**EMPOLI**, ĕm'pô-lă. An episcopal city of the Province of Florence, Italy, on the left bank of the Arno, 19 miles west of Florence (Map: Italy, E 4). Empoli manufactures straw plaiting for bottles, cotton and leather goods, hats, faience, glass, and macaroni, and market fruits and vegetables. Pop. (commune), 1901, 20,404; 1911, 21,566.

**EMPOLI**, JACOPO DI CLEMENTI DA. See CLEMENTI, JACOPO DI, DA EMPOLI.

**EMPORIA.** A city and the county seat of Lyon Co., Kans., 61 miles southwest of Topeka, on the Missouri, Kansas, and Texas, and the Atchison, Topeka, and Santa Fe railroads (Map: Kansas, F 6). It is the seat of the College of Emporia (Presbyterian), opened in 1883, a State normal school, and the Emporia School of Music and Art, and contains a fine Federal building, a Carnegie and a railroad library, and a hospital. Emporia is in a fertile agricultural region, ships large quantities of cattle, and has flouring mills, foundries and machine shops, corrugated-metal works, carriage factories, marble works, ice and cold-storage plants, and wholesale houses. Emporia was settled in 1856, incorporated in 1870, and adopted the commission form of government in 1910. The water works are owned and operated by the city. Pop., 1900, 8223; 1910, 9058; 1914 (U. S. est.), 9328.

**EMPO'RIUM.** A borough and the county seat of Cameron Co., Pa., 100 miles west-northwest of Williamsport, at the junction of the Buffalo and Philadelphia and Erie divisions of the Pennsylvania Railroad (Map: Pennsylvania, E 3). It has large powder plants and manufacturing of incandescent lamps, paving brick, flour, iron, lumber, sole leather, etc. The electric-light plant is owned by the municipality. Pop., 1900, 2463; 1910, 2916.

**EMP'SON, WILLIAM** (1791-1852). An English editor. He was educated at Winchester and at Trinity College, Cambridge, and was one of the most active contributors to the *Edinburgh Review* from 1823 to 1849, becoming editor of that publication upon the death of Napier in 1847. From 1824 until his death he was professor of law at the East India College, Haileybury.

**EMP'PYE'MA** (Neo-Lat., from Gk. ἐμπύημα, suppuration, from ἐν, en, in + πύον πυον, pus). An internal suppuration. The term is now applied specifically to a collection of pus in the pleura, but collections of pus in the accessory cavities of the nose, as the antrum of Highmore, or the frontal sinus, are also referred to as empyemas.

**EMP'PYREU'MA** (Neo-Lat., from Gk. ἐμπύρευμα, live coal preserved under ashes, from ἐμπυρεύειν, empyreueîn, to kindle, ἐμπυρος, empyros, fiery, from ἐν, en, in + πῦρ, pyr, fire). The burned smell and acrid taste which result

when vegetable or animal substances are decomposed by a strong heat.

**EMPYROMANCY.** See DIVINATION.

**EMS**, ĕms, or **BAD EMS**, băt ĕms. One of the oldest and most famous watering places in Europe, situated in the Prussian Province of Hesse-Nassau, on the Lahn, about 8 miles from its junction with the Rhine, and 10 miles east-southeast of Coblenz (Map: Prussia, B 3). It lies in a charming valley surrounded by thickly wooded hills. Its many warm mineral springs, varying in temperature from 79° to 135° F., are considered especially efficacious in the treatment of diseases of the respiratory organs. The three springs discovered about 1865 and those opened since are all owned by the government. Ems is visited annually by over 12,000 patients and as many tourists. The Kurhaus, the older portion of which dates from the sixteenth century, contains the principal springs and baths. It is connected by an iron colonnade with the Kursaal erected in 1838, which contains reading rooms and concert halls. In Spiess Ems, the new quarter, are the Römerbad and the New Bath House. Many of the neighboring heights command extensive views of the Lahn valley, notably the Malberg on the left bank of the river. In the vicinity are important lead and silver mines. Pop., 1900, 6494; 1910, 6777. Ems was known to the Romans. In 1172 it came into the possession of the counts of Nassau. In 1866, with the Duchy of Nassau, it was united with Prussia. At Ems, on July 13, 1870, occurred the famous interview between King William of Prussia and the French Ambassador Benedetti, which precipitated the Franco-Prussian War.

**EMS.** A river in the northwestern part of Germany, rising in Westphalia, on the southwest slope of the Lippe Forest (Map: Prussia, B 2). It flows first in a westerly, then in a northwesterly, direction, entering Hanover, in which it flows north, and emptying into the North Sea, after a course of about 210 miles. The Ems drains an area of about 4600 square miles. Its chief affluents are the Aa, the Haase, the Hessel, and the Leda, all from the east. It is navigable for small vessels for only 25 miles from its mouth, but it supplies water to numerous canals, which are used for both irrigation and navigation. Nearly the whole of its course from Münster to Papenburg is paralleled by canals on the east side, while on the west connection is formed with the network of canals of Holland, and by the Dortmund-Ems Canal with the Westphalia coal region.

**EMS, RUDOLF VON.** See RUDOLF OF EMS.

**EMSER**, ĕms'ĕr, **HIERONYMUS** (1477-1527). A German Catholic theologian. He was born at Ulm, studied at the University of Basel, and lectured at Erfurt, where Luther was one of his hearers. From 1505 he was secretary to Duke George of Saxony, who employed him to collect material regarding Bishop Benno of Meissen, and in 1510 sent him to Rome to obtain the canonization of that prelate. After the Disputation of Leipzig in 1519, he broke with Luther, although he had sympathized with a moderate reform. Luther was very violent against him, and he was particularly bitter against Luther's translation of the New Testament, which, he declared, contained 1400 lies and errors. In 1527 he published his rendering of the New Testament from the Vulgate, which is Luther's

adapted to the Vulgate text. In 1523 he translated into German the anti-Lutheran tract of Henry VIII. Emser's crest was a goat's head, and Luther delighted in calling him "Bock-Emser" and "Egoceros." Consult: Waldau, *Nachricht von Hieronymus Emsers Leben und Schriften* (Anspach, 1783); Kawerau, *Hieronymus Emser* (Halle, 1898); Enders, *Luther und Emser* (ib., 1890-92), containing his writings against Luther.

**EMU**, or **EMEU** (Portug. *ema*). A ratite bird of Australia, closely allied to the cassowary, but larger, sometimes weighing about 130 pounds, and next to the ostrich in size. It differs from the cassowary in having the bill horizontally depressed, the head feathered and destitute of a bony crest, and the throat nearly naked and with no pendent wattles. The feet are three-toed, as in the cassowary, and the wings are mere rudiments hidden beneath the loose filamentous feathers of the body. The color is dull brown, mottled with dingy gray; the young are striped with black. When assailed, emus strike backward and obliquely with the feet, like the cassowary, and they are so powerful that a stroke of the foot has broken a man's leg. They cannot fly, but run very fleetly. They are timid and peaceful and trust altogether to speed for safety, unless hard pressed. In a wild state they sometimes occur in small flocks, but they have now become extinct in the more thickly settled parts of Australia. The extinction of the genus will be prevented, however, by its being preserved in a state of domestication, as they are very easily domesticated and breed readily in that state. The flesh is rather tough for eating. The common emu has frequently been bred in Europe, where it is constantly seen in menageries or domesticated in English parks. The eggs are six or seven in number, dark green; the male performs the principal part of the incubation. The fat beneath the skin contains much oil; six or seven quarts are obtained from a single bird, and on this account it has been much hunted in Australia. Its food consists chiefly of roots, fruits, and herbage. Besides a drumming sound, which is frequently emitted, it gives forth a high-pitched piping note. It is probable that only one species of emu is living, *Dromæus nova-hollandiæ*. Several have recently become extinct. These constitute the family Dromæidæ, of which a fossil species has been discovered in the Tertiary deposits of India. Consult Matthew, *Birds of Australia*, vol. i (London, 1910-11). See PLATE OF CASSOWARIES.

**EMU**, or **EMEU WREN** (Australian *emu* + Eng. *wren*). A very small, brown, ground-keeping flycatcher (*Stipiturus malachurus*) of Australia, also called pheasant-tailed warbler. It is so named because of the great elongation of the central feathers of its tail, which are so loosely constructed as to resemble the plumage of the emu. The birds are described as flying with difficulty and preferring to creep about among herbage and low bushes near the ground like little field mice, where the male utters a weak but pretty song. Consult Campbell, *Nests and Eggs of Australian Birds* (Sheffield, 1900). See PLATE OF WRENS, WARBLERS, ETC.

**EMULSIN** (from Lat. *emulsus*, p.p., *emulgere*, to milk out, from *e*, out + *mulgere*, to milk). An enzyme found in plants, which decomposes various glucosides into glucose (grape sugar) and other products. It occurs in cer-

tain members of the rose family, notably in the almonds, both sweet and bitter, and the cherry laurel, in some spurge belonging to the genus *Manihot*, and in several common molds and lichens. Amygdalin, salicin, and other glucosides are split up by emulsin, which acts best in neutral solutions and at temperatures between 30° and 40° C. (86° and 104° F.). It is destroyed at about 80° C. (176° F.). See ENZYME; GLUCOSIDE; BENZALDEHYDE; DIGESTION IN PLANTS.

**EMULSION** (Fr. *émulsion*, from Lat. *emulgere*, to milk out). Emulsions are liquid preparations consisting of oily, fatty, resinous, or otherwise insoluble substances suspended in watery liquids by the intervention of gum, mucilage, or other viscid material called emulsifying agents. Natural emulsions comprise products of animal or vegetable origin, consisting of oily or resinous substances so combined with gum or albumin as to be readily miscible with water without separation. Milk and egg yolk are such typical emulsions, and seeds and gum resins form emulsions when triturated with water. Artificial emulsions are made by thoroughly mixing the oil with the emulsifying agent, adding a certain proportion of water and triturating the mixture in a mortar or agitating it in a flask. Volatile oils require the addition of a fixed oil to produce a stable emulsion. Water-insoluble substances—salicylic acid, chloroform, salol, etc.—may be emulsified in the same way as oil of turpentine, i.e., by the addition of gum tragacanth or acacia. In the United States Pharmacopœia six emulsions are official: of almonds, asafetida, chloroform, cod-liver oil, cod-liver oil with hypophosphites, and oil of turpentine.

**ENALIDS** (from Gk. *ἐν*, *en*, in + *ἄλς*, *hals*, sea). In botany, the members of the marine fixed vegetation (benthos) (q.v.) which grow attached to loose soil. Submerged eel-grass meadows form one of the chief enalid societies.

**ENALIOSAURUS**. See ICETHYOSAURUS; PLESIOSAURUS.

**ENAMBUC**. See ESNAMBUC.

**ENAMEL** (*en* + older form *amel*, Fr. *émaîl*, OF. *esmail*, It. *smalto*, from OHG. *smalz*, Ger. *Schmalz*, butter, from *schmelzen*, to melt, Gk. *μέλειν*, *meldein*, to melt). A glaze coating applied by fusion to any substance which will bear the necessary heat, especially to metals and to pottery (q.v.). Enamel is really a kind of glass composed of silica, minium, and potash, to which the desired color is given by means of metallic oxides. It may be applied so as to cover the whole surface, and the new surface thus formed may be painted with vitrifiable colors, or the enamel may be applied to parts of the surface only, so that the colors of this partial application, combining with the colors of the object itself, may produce a decorative effect; and, finally, the enamel may be treated as a transparent or translucent mass, showing its color effect equally by transmitted and by reflected light. In each of these methods the enamel itself is provided in lumps or sticks or rods, each piece being usually of a separate solid color and having been previously vitrified. This material is ground very fine, mixed with gum water or some similar adhesive vehicle until it forms a paste, and can be applied with a brush. The object is then put into the enameling furnace, and in the heat the enamel passes from the condition of a dampened powder, through the state of flux or semifluidity, into a hard,

glossy, bubble-like mass looking very like the wet powder of its first condition.

Modern glass of brilliant iridescent surface is not generally enameled; but the glass lamps suspended in mosques throughout the Levant, and the glass vases, drinking vessels and the like, which are also of Saracenic or Moorish work, are decorated by enameling in the proper sense. The distinction is obvious to one who notes that in the Oriental pieces the body of the glass vessel shows between the usually opaque and projecting masses of the enamel which has been put on separately and fused and hardened separately. Similar work has been done in Europe, though rarely. So, in a porcelain vase decorated in colors, the painting which is applied over the glaze is of the nature of enameling and is easily seen to be an application made after the completion of the body of the vase. On the other hand, when a Chinese kettle or jardinière of thin metal is coated on both sides with a solid, opaque, uniform coating, giving it a finished look somewhat, but not quite, like that of porcelain, and when this hard and glassy surface is painted with flowers and the like, it is surface enamel of a kind very common in the Orient, though hardly used in European handiwork, except in connection with Limoges enamel, as mentioned below. These two methods of using the decorative quality of enameling are then distinguished as (1) that which covers the whole surface, and (2) that which is so applied to another surface as to form with it a kind of mosaic pattern.

Of the first kind, one variety has been described above; another is that usually known as Limoges enamel. In this the enamel is applied to a plate of metal with the express purpose of affording a ground for painting, and the paintings are often of very elaborate character. Thus, the work of the sixteenth century, in which are distinguished the names of Pénicaud, Jean Courteys, and Léonard Limousin, is famous for the use of completely developed painting of the figure, treated, of course, decoratively, i.e., without shadows and with the high lights often touched with gold, but with the figures completely modeled and the story completely told. At a later time these proper limitations of the art disappear, and the eighteenth-century Limoges enamel resembles very closely the work on paper or vellum, the slight relief being the chief distinctions. The tendency of the time was away from brilliant coloring, and much of the later Limoges enamel was painted in monochrome.

That enamel which forms a mosaic pattern relieved upon the background of the original substance may be on glass, as stated above, and then the glass is usually translucent, and the pattern, in several colors, with gold, is in opaque body and in slight relief upon it. When applied to ceramic ware, as Chinese porcelain, it is usually combined with blue underglaze painting and is lost in the general color effect. When it is applied to metal, this is done according to one of two methods—the cloisonné and the champlevé methods. Cloisonné work is that which is done by building up upon the metal surface very small partitions (*cloisons*), dividing up the field, as of copper, into little compartments; each of these compartments to be filled with enamel. Champlevé enameling is done by engraving out the solid surface so as to

leave little pools or hollows, which are to be filled with enamel. In either case a metal line or narrow space separates the pieces of enamel one from another. It is usual to grind the hard-finished enamel down until the glossy surface and the metal surface coincide and can be polished together. But in Oriental enamels it is not very uncommon to see a rougher and more picturesque treatment with the little compartments or hollows filled only in part, or else more than filled, so that considerable diversity of surface results. The very finest pieces of Oriental cloisonné enamel are of extraordinary brilliancy of decorative effect. The surface is very complete and perfect, with only minute bubbles to break its uniformity and only slight discolorations, as of pale-brown spots on the blue, to give its color some additional vivacity. Each compartment may be of solid, uniform color, or may itself contain a gradation, as of red passing slowly into white. The finest in color are Chinese, of the sixteenth or seventeenth century of our era. Very recent Japanese pieces show the partitions reduced almost to nothing—very slender and of no separate effect, the color masses of the enamel seeming to touch; whereas in old Chinese work they might be  $\frac{1}{4}$  of an inch wide and present even broader surfaces where several strips met and were secured together.

A highly artistic variety of enamel is the so-called *basse taille*, in which the metal, usually gold or silver, is carved in a very low relief, and a transparent enamel is fused to the incised portions. *Basse taille* may be defined as cloisonné with the metal ground removed, and hence a transparent enamel. See NIELLO.

**History.** The art of enameling was practiced among the most ancient of civilized peoples. The Egyptians and Babylonians used enameled bricks of wonderful clearness and lustre for the decoration of whole apartments of their palaces, as may still be seen in the palace of Rameses III at Tel el-Yehudia and that of Nimrod recently excavated in Babylon. The Egyptians also used cloisonné enamel in their exquisite jewelry. The Greeks preferred cloisonné in their jewelry and other objects of decorative art and as an accessory to the noblest works of sculpture, as in the embroidery of the draperies of the Olympian Zeus by Phidias. Its use in jewelry, etc., was continued by the Romans, but it was reserved for the Byzantines to become the greatest masters of cloisonné. With the skill of design equalled only by a sense of color, they used it for a multitude of ecclesiastical objects—missal covers, shrines, tabernacles, crosiers, chalices, ciboria, crosses, and the like. The ground was of gold, which explains why so few examples survive, and simple colors, opaque and of dull finish, were preferred; the design was purely decorative. The art was practiced as early as the reign of Justinian, and, although interrupted by the iconoclastic movement, the development attained new splendor in the ninth and tenth centuries and lasted until the downfall of the Empire. The most magnificent example of Byzantine enamel is the well-known Pala d'Oro (q.v.) in St. Mark's, Venice.

Among Western nations champlevé was the principal variety of enamel used. The Celtic tribes seem to have been especially skilled, and during the early Middle Ages the Irish in particular wrought beautiful ecclesiastical objects, as may be seen in the Dublin Museum. The earliest important centre of the art on the

Continent was Cologne, where a school flourished during the tenth, eleventh, and twelfth centuries. Its works are scattered throughout the Rhinelands and may be studied in such noble examples as the Shrine of the Magi in Cologne Cathedral, and the altar front at Klosterneuburg by Master Nicolas, of Verdun. From Cologne the art was probably transplanted to Limoges, which attained great importance in the second half of the twelfth century and remained the principal centre of the art of enamel in western Europe throughout the Gothic period. Fine examples may be seen in the several shrines (chasses) of the Morgan collection, New York. Limoges was also the principal centre of enamel painting (properly so called) of the fifteenth, sixteenth, and seventeenth centuries, described above. In the early fourteenth century the Italians invented the so-called basse-taille enamel, of which there is a fine example, the "King's Cup," in the British Museum.

Among the Oriental nations China has produced cloisonné ware of a distinctly national character, comparable in beauty and splendor to that of Byzantium. The art was not a native one, but was introduced from Constantinople by the Mongols in the North and the Arabs in the South as intermediaries. It attained its most perfect development under the Ming dynasty (1368-1643), especially during the reign of Ch'ing-t'ai (1450-56); but splendid examples were produced in the Manchu period, particularly during the reigns of K'ang-hsi (1662-1722) and Ch'ien-lung (1736-95). It was used not only for the adornment of the vessels required by the temple service, but also in vases, bowls, and a variety of other objects of secular use.

A revival of the art of enameling took place in the late nineteenth century. The artist now has at his command better and more varied colors, purer metals, and more perfect appliances for the application of heat; but it cannot be said that the art has as yet equaled its past excellence. It is still used in connection with jewelry and other decorative work, but more frequently in enamel painting. Among the enamel painters of recent times are Claude Popelin, Grandhomme, and others in France, Bastanier in Berlin, Mach in Vienna, and Hubert Herkomer and Alexander Fisher in England.

There are good collections of enamels in the museums of decorative arts in London, Paris, Berlin, St. Petersburg, and other centres. One of the finest in existence is in the J. Pierpont Morgan collection—rich in rare Byzantine cloisonné, German and Limoges champlevé, as well as in the painted enamels of Limoges. The Brooklyn Institute Museum, New York, has a remarkable collection of Chinese cloisonné, presented by S. P. Avery.

**Enamel in Industry.** In the purely utilitarian employment of enamel its purpose is to protect the surface to which it is applied from oxidation or the action of corrosive substances. The earlier enameled ware was usually thick, but enamel is now successfully applied to sheet iron and sheet steel. The utensils are pressed out of the sheet metal according to the process described under DIES AND DIE SINKING and under HOLLOW WARE. The metal foundation having been properly prepared by annealing to stand the heat, it is dipped in the melted glaze and fired in an oven similar to that employed for

the glazing of pottery, which is kept at a temperature of about 1500° F. The constituents of the glaze and their proportions vary in the different factories and are carefully guarded trade secrets. The color of enameled ware is determined by the metallic oxides used in the glaze and does not materially alter the character of the enamel, although a pure white enamel is likely to be less tough than gray. The quality of the enamel depends not only on the character of the glaze, but also upon the number of coats applied. By one process four successive coats are applied, the first three of which are simply dried, while the fourth is burned at 1500° F. In another, two successively fused coats are applied. In the cheaper grades of enamel ware arsenic is said to be used in place of the oxide of tin, thus . . . the cost, according to the statement of a leading manufacturer, by 75 per cent. Agateware is simply a trade name for a variety of enameled ware, so called on account of its mottled appearance. Enameled ware, even of the highest grade, is likely to be injured by excessive heat, which, by making the iron expand faster than the glaze, cracks the latter. It is also liable to be affected by acids wherever there is the slightest break in the continuity of the surface of the enamel. When once acid penetrates the surface so that it can act on the iron underneath, it will gradually undermine the glaze so that it peels off.

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**ENAMELED CLOTH.** A material used as a substitute for leather in making traveling bags covering upholstery and the like, and also for covering boxes. The process was invented in Newark, N. J., in 1849. It consists in covering cotton cloth with repeated coatings of a composition consisting of linseed oil, lampblack, resin, and other ingredients. The cloth is passed between heavy iron rollers, from one of which it



receives the coating of composition; sometimes this is spread by passing the cloth under a knife. Between the successive coatings (five or six in number) the cloth is dried and rubbed down with pumice stone, and after the last coat it is varnished. Last of all, the cloth is often passed through rollers, one of which has a surface that it stamps the material with indentations. Enamel cloth is somewhat similar to oilcloth in its method of manufacture, but it is much lighter, more flexible, and put to very different uses.

**ENAMEL OF TEETH.** See **TEETH**.

**ENAMEL PAINT.** See **PAINTS**.

**ENARE, ä-nä'rä, or ENARA.** A lake in the Finnish government of Uleåborg, not far from the Norwegian frontier (Map: Russia, Cal). It covers an area of nearly 550 square miles and receives a number of tributaries, including the Ivalo. Its outlet, the Pasvik, empties into the Arctic Ocean and forms partly the boundary line between Russia and Norway.

**ENAREA, ä-nä'rë-ä.** A hilly region of Abyssinia, between lat. 7° and 9° N. (Map: Africa, H 4). Its population is about 40,000. Capital, Saka.

**ENARGITE.** A sulpharenide of copper, sometimes occurring in black metallic, orthorhombic crystals, but more commonly in granular masses. It is found associated with other copper minerals in Chile, Peru, and Mexico, also in South Carolina, Colorado, Utah, California, and in the Tintic district of Montana. It is much used as an ore of copper.

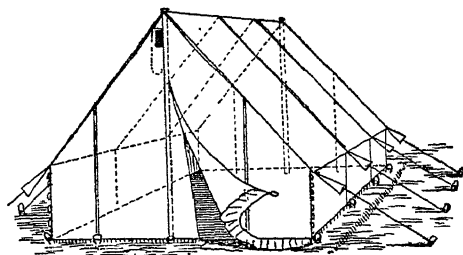
**ENARTHROSIS** (Neo-Lat., from Gk. ἐνάρθρωσις, ball-and-socket joint, from ἐν, en, in + ἄρθρον, arthron, joint). The term used by anatomists to express the kind of joint (q.v.) which admits of the most extensive range of motion. It occurs in the hip and shoulder joints.

**ÉNAULT, ä'nô', LOUIS** (1822-1900). A French author, born at Isigny (Calvados). He wrote a large number of novels and books of travel, e.g., *Pèlemêle* (1862); *Stella* (1863); *Olga* (1864); *Le baptême du sang* (1873); *Nadège* (1895); *Myrio* (1898). He made the French translation of *Uncle Tom's Cabin* (1853).

**ENCÆNIA, or ENCENIA** (Lat., from Gk. ἐγκαίνια, enkainia, from ἐν, en, in + καίνος, kainos, new). Dedication festivals held in early Christian times to consecrate a new church or a heathen temple to Christian use and later repeated on the anniversaries of such occasions. At first they were simple, but by the beginning of the seventh century they had come to have the character of a fair with booths, dramatic representations, singing, and dancing. They were disapproved by the Council of Châlons (650). The name is also applied to the festivals held by the University of Oxford, in June, in honor of its founders and benefactors. See **COMMEMORATION**.

**ENCAMPMENT.** During active operation in the field troops are generally quartered in tents. The principal tents in use in the United States are the shelter, just large enough for two men to sleep under and separable into two parts, each carried by one of the soldiers on the march; the small pyramidal, with a floor space of about 9 × 9 feet; the large pyramidal, 16 × 16 feet; the hospital, 14 × 14½ feet; and the storage, 17 feet, 10 inches by 20 feet, 5 inches. In putting tents up in rows a space between the tents at least half the width of the tent should be left for the guy

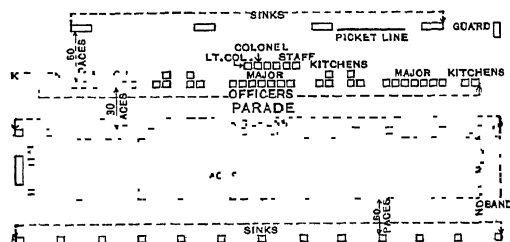
ropes and passages. Unless the soil is unusually porous, small trenches should be dug around each tent to carry off rain water, which might otherwise make the tent uninhabitable. The



U. S. A. COMMON TENT

floors of the tents should ordinarily be raised above the ground. The laying out of shelter-tent camps can be effected as a matter of drill and without any special staking out of the camp.

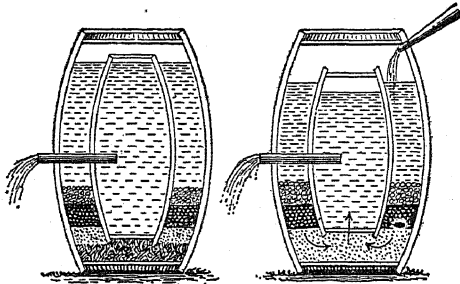
Types of arrangement for a camp for each of the arms and for an infantry division are shown in the Regulations. That shown in the accompanying cut is suitable for the infantry:



A simple way of laying it out quickly is with the eye to stake out the line of the front of the company officers' tents, beginning at one end of the line and laying off lines at right angles to this for the front of the living tents of the men. The position of the front tent poles for the latter tents can then be indicated by pacing, or by stretching a string having knots at the proper intervals. The company streets should, if possible, be at least 20 paces wide in the clear. If the camp is to last more than a few days, and the requisite ground is available, space is left for mess tents near the company kitchens. The hospital should be located, if possible, on a particularly healthful site, as far removed as is convenient from the living tents. The guard tent is placed on the line of sentinels conveniently for general access to the camp from the neighboring road. Arranged in this manner the camp for a regiment of infantry can be crowded into 10 acres; if ground is available, it is better to utilize more space. A cavalry camp is arranged on a similar plan, with the addition of provision for the horses. These are placed generally either in the prolongation of the company streets beyond the latrines or between companies. While a large camp lends itself to comfort and sanitation, it has the disadvantage of increasing the guard and police duty. In the presence of the enemy, camps and bivouacs must be modified to afford the best protection for men, animals, and trains.

Where troops have remained in one site for a long period in cold weather, log and board

huts have been constructed for their occupancy. In selecting a site for a camp there is frequently little latitude, but wherever practicable it should be placed in a healthy location, especially avoiding everything in the nature of a marsh. It is essential to encamp within reasonable distance of a water supply and desirable to be near fuel and grass. As a rule, provision should be made for not less than five gallons of water for each man, and 10 gallons for each animal, in the camp. On going into camp efficient arrangements should be effected for the protection of the water supply and for distributing it to the men and animals. If a source of supply is to be used for a considerable time, particularly if animals are to be watered there, an area should



WATER FILTERS, BRITISH ARMY PATTERN.

be drained and paved to prevent the ground from becoming muddy. Where the supply is scanty, tanks should be constructed for catching the water at night and at other times when it is not being consumed. Where the best water obtainable is impure, it should be boiled or chemically treated and filtered—if practicable, through filters carried by the troops, otherwise by temporary ones constructed of sand, gravel, and charcoal. Where transportation is available, well augers, well points, canvas water bags, barrels, and pumps should be carried. For cooking, United States troops are provided with field ovens, which are supplemented by small fire-places in the ground. See FIELD COOKING.

The physical problems connected with encampment vary with the nature of the country and the season of the year. Among the most important are those relating to the disposition of the refuse matter. No general rule can be given covering this, excepting that all trash and garbage should be removed completely from the site, either by transportation or by burning. Fuller details on these subjects will be found in Beach, *Manual of Military Field Engineering* (Kansas City, 1896); Fieberger, *Manual of Field Fortification* (New York, 1901); *Field Service Regulations*, United States Army (Washington, 1914); *Infantry Drill Regulations*, United States Army (1911); and the *Chatham Test-Book in Military Engineering* (London, 1894). See CAMP; CAMP EQUIPAGE.

**ENCAUSTIC PAINTING** (Lat. *encausticus*, Gk. ἐγκαυστικός, *enkaustikos*, burnt in, from ἐγκαλεῖν, *enkaiein*, from ἐν, *en*, in + καλεῖν, *kaiein*, to burn). A method of painting practiced by the ancients, especially by the Greeks, in which the colors were mixed with wax and resin and softened by aid of fire. Some Greek portraits have come down to us, but no important specimens of Greek encaustic painting other than these are known to be extant, and it is an art the secret of which is largely lost. The cantering

or heating of the painting after completion rendered the colors more brilliant than tempera or fresco. Pliny describes three processes of encaustic painting used by the Greeks and Romans. In the one most commonly practiced the wax colors were spread within determined outlines by means of a spatula. Both the spatula and colors were heated in a brazier standing beside the painter. As practiced by the ancients, encaustic painting retained its integrity of color for a longer period than any other medium known to the painted arts. The "Battle of Marathon," painted by Polygnotus, was preserved under an open portico at Athens for more than 900 years. Some of the mural paintings in Pompeii are encaustic; and very interesting survivals are the Greek portrait panels from the Fayum (Egypt), usually on wood and generally used as a covering for the heads of mummies. The Metropolitan Museum, New York, possesses a number of good examples, together with the spatula and implements used in the process. As early as the middle of the nineteenth century experiments were made to revive encaustic painting, and this was continued during the century; but nothing satisfactory has as yet been perfected. One of these modern methods, that of Fernbach (1793–1851), was used in the decoration of the Hohenstauffer Hall of the Royal Palace in Munich. Consult Thomas, *Methods of Mural Decoration* (London, 1869); Cros and Henry, *L'Encaustique et les autres procédés de peinture chez les anciens historique et technique* (Paris, 1884); Donner von Richter, *Ueber Technisches in der Malerei der Alten, insbesondere in der Enkaustik* (Munich, 1885); Laurie, *Greek and Roman Methods of Painting* (Cambridge, 1910).

**ENCAUSTIC TILES.** See TILES.

**ENCEINTE**, ăn'sănt' or ăn'sănt' (Fr. inclosure). A term in military engineering and fortification, used to denote the area within the principal encircling wall of a fortified place. See FORTIFICATION.

**ENCEL'ADUS** (Lat., from Gk. Ἐγκέλαδος). In Greek legend the son of Tartarus and Gæa. With the other hundred-handed giants he made war on the gods, but was slain by Zeus and buried under Mount Etna. (See GIANTS.) Earthquakes were explained as the results of his movements as he tried to free himself, and the flame of the mountain was regarded as his fiery breath. Consult Longfellow, *Enceladus*, and King *Robert of Sicily*.

**ENCENIA.** See ENCENIA.

**ENCEPH'ALAR/TOS.** A genus of African cycads, including about 12 species. See CYCADACEÆ.

**ENCEPHALOCLE**, ɛn-sĕf'ă-lô-sĕl (from Gk. ἐγκέφαλος, *enkephalos*, brain, from ἐν, *en*, in + κεφαλή, *kephalē*, head + κήλη, *kēlē*, tumor). The term applied to a tumor projecting through the skull, in one of the parts where the bones are incomplete in infancy, and consisting of a protrusion of the membranes of the brain, containing a portion of brain itself. The most common situation of such tumors is in the middle line, more often in the frontal than in the occipital region. Some of these cases can be cured by surgical measures.

**ENCHIRIDION**, ɛn'ki-rid'i-ŏn (Lat., from Gk. ἐγχειρίδιον, *enchēiridion*, handbook). A manual compiled by Arrian containing a digest of the teachings of the Stoic philosopher Epictetus (q.v.).

**ENCHONDROMA**, ěn'kōn-drō'mā (Neo-Lat., from Gk. ἐν, *en*, in + χόνδρος, *chondros*, cartilage). The term employed in anatomy to signify an abnormal growth. These growths most commonly occur in connection with the bones, and they are not infrequent in some of the glandular structures. See **TUMOR**.

**ENCINA**, ěn-thē'nā, **JUAN DEL** (?1469-?1529). The father of the Spanish drama, supposed to have been born at the village of La Encina, near Salamanca, at the university of which he is said to have been educated. He is also supposed to have been present at the surrender of Granada. In 1492, also, he entered the household of the Duke of Alba and soon after began to entertain his patrons with original comedies, in some of which he himself took part. In 1498 he went to Rome, where he became maestro di cappella to Leo X. Afterward he took orders, celebrated his first mass at Jerusalem in 1519, and after his return to Rome was appointed prior of the monastery of León. He is supposed to have died at Salamanca. Of Encina's poems, more than 170 lyrics have survived, many of them with musical settings by their author. More interesting than any of these, however, are the 14 plays, which are classified as *églogas*, *representaciones*, and *autos*, which differ from one another in little except name, being all presentations of extremely primitive themes, the subject of which is sometimes sacred and sometimes not. He is chiefly interesting as marking the transition from the purely religious to the secular stage and as exhibiting, in embryo at least, nearly all, if not indeed absolutely all, of the *genres* that were developed in the course of the great sixteenth and seventeenth centuries. The best edition of his works is that of Francisco Asenjo Barbieri, *Teatro completo* (Madrid, 1893). The lyrics (68 of them), with the author's own music, appear in Francisco Asenjo Barbieri, *Cancionero musical de los siglos XV y XVI* (Madrid, 1894). Consult also R. Mitjana, *Sobre Juan del Encina, músico y poeta* (Málaga, 1895); M. Menéndez y Pelayo, *Antología de poetas líricos castellanos*, vol. vii (Madrid, 1898); E. Cotarelo y Mori, *Estudios de Historia Literaria de España* (ib., 1901); R. Mitjana, *Cancionero de Uppsala* (Uppsala, 1909); E. Díaz Jiménez y Molleda, *Juan del Encina en León* (Madrid, 1909).

**ENCISO**, ěn-thē'sō, **MARTÍN FERNÁNDEZ DE**. See **FERNÁNDEZ DE ENCISO**, **MARTÍN**.

**ENCKE**, ěn'ke, **ERDMANN** (1843-96). A German sculptor. He was born in Berlin and studied at the academy in that city and with Albert Wolff. Several fine pieces of statuary in the German capital were designed by him, among them the following: "Friedrich Ludwig Jahn," bronze statue (Hasenheide); "Frederick I, Elector of Brandenburg" (façade of town hall); "Queen Louise of Prussia" (Thiergarten); a charming group of the Electress Elizabeth of Brandenburg and her son Joachim (National Gallery); and the sarcophagi of Emperor William I and Empress Augusta in the mausoleum at Charlottenburg. His works combine the severity of form of the Rauch school with a healthy realism and a touch of poetry and romance. He also executed a number of important bronze portrait busts, in which he used polychromy with success. He was appointed a professor of the Berlin Academy in 1883.

**ENCKE**, **JOHANN FRANZ** (1791-1865). A German astronomer, born in Hamburg, where his

father was a clergyman. After studying at Göttingen, under Gauss, he took part in the campaign of 1813-14 and in 1815 served in the Prussian army as lieutenant of artillery. On the establishment of peace he left the service and became assistant, and afterward principal, astronomer in the observatory of Seeberg, near Gotha. In 1825, chiefly at the instance of Bessel, he was called to Berlin to become secretary of the Academy of Sciences and director of the observatory. While at Gotha the astronomical prize offered by Cotta was awarded to Encke by the judges, Gauss and Olbers, for his determination of the orbit of the comet of 1680. This led him to investigate another problem, viz., the determination of the distance of the sun from the earth. Encke's results, based upon the two transits of Venus, in 1761 and 1769, were published in two separate tracts, entitled *Die Entfernung der Sonne* (1822-24). His best-known work, however, is his discussion of the orbit of the comet discovered by Pons, Nov. 26, 1818, which has a short period of about 1200 days, and which has since gone by the name of Encke's comet and has appeared regularly. (See **COMET**.) Encke's researches on this subject are contained in the transactions of the Berlin Academy. He endeavored to explain a remarkably regular change in the comet's period of revolution as the result of some resisting substance in the space traversed by the comet. There is, however, much doubt among astronomers as to the correctness of this hypothesis. In 1830 he undertook to edit the Berlin *Astronomisches Jahrbuch*, in which he published a number of astronomical papers. He issued four volumes of *Astronomische Beobachtungen auf der Sternwarte zu Berlin* (1840-56). His scientific writings were collected and published under the titles *Astronomische Abhandlungen* (3 vols., Berlin, 1868) and *Gesammelte mathematische und astronomische Abhandlungen* (3 vols., ib., 1888-89). Consult Bruhns, *Johann Franz Encke* (Leipzig, 1869).

**ENCRATITES**, ěn'krā'tīts (Lat. *Encratitæ*, Gk. Ἐγκρατῖται, *Enkratitai*, from ἡγκρατής, *enkratēs*, self-controlled, from ἐν, *en*, in + κράτος, *kratos*, power). The name of early ascetics in the Christian Church. They arose at Rome about 172 and were numerous in Asia Minor. Their head and leader was Tatian (q.v.). They forbade marriage, the eating of the flesh of animals, and the use of wine, some going so far as to substitute water for wine in the Eucharist. They were found as late as the fourth century.

**ENCRI'NAL**, or **ENCRI'NITAL**, **LIME-STONE**. A name given to some limestones, from the great abundance in them of the calcareous fragments of crinoidea (q.v.), whole masses of the rock being almost entirely composed of them. There are large beds in the Hamilton and Helderberg groups in New York State.

**ENC'CRINITES**. See **CRINOIDEA**.

**ENCYCLICAL LETTERS** (from Lat. *encyclio*, from Gk. ἐγκύκλιος, *enkyklios*, circular, from ἐν, *en*, in + κύκλος, *kyklos*, circle). A term denoting, in a general sense, circular ecclesiastical letters, whether from a council, bishop, or pope. In the early Church the letters sent by the members of a council to all the churches, or by a bishop to all the churches of a particular district or diocese, were so called; but the term is now applied exclusively to letters addressed by the Pope to all the bishops of the Roman Catholic church, which usually contain injunctions

and warnings against dangers which may threaten the church. One of the most remarkable encyclicals was that issued by Pius IX in 1864, accompanied by a syllabus in which he condemned 80 alleged errors in modern ideas of religion and civilization. His successor, Pope Leo XIII, issued a number of them on such subjects as Socialism, Bible study, capital and labor, and the reunion of Christendom. Pius X issued several of importance, including that in which he defined and condemned modernism (1907).

**ENCYCLOPÆDIA** (Gk. ἐγκυκλοπαιδεία, *enkyklopaideia*, a barbarous derivative of the Greek phrase ἐγκύκλιος παιδεία, *enkyklios paideia*, circular, complete education). Originally the entire group of studies which every free-born Greek youth was required to complete in preparation for active life—the liberal curriculum. In this sense the Greek phrase was adopted by the Romans. Its signification, however, was early widened, both in Greek and Roman usage, to include systematic study of, or instruction in, all the branches of learning—of the entire “circle” of the arts and sciences, or of a special group of them; and this remained its dominant meaning until a comparatively recent time. At present it survives chiefly in the technical use of the word in systematic theology and philosophy to designate the investigation of the relations of the various special subjects which those disciplines include. With this idea of “encyclic” education was also soon associated the notion of collecting the materials of such instruction into a single work, in which the contents and relations of the various arts and sciences should systematically be expounded. Attempts to produce books of this kind were made at an early date, though the name “encyclopædia” was not given to them until the 17th century. This is now its common application.

What has been said of the origin of the word explains also its characteristic of the earliest encyclopædies. They were treatises or groups of connected treatises adapted for continuous reading and study and not mere repositories of knowledge. They were designed to serve rather as all-comprehensive textbooks than as works of reference in the modern sense of that phrase. And their substance corresponded to their form, for they contained for the most part simply the more or less extensive accumulations of learning made by their authors individually, and bore no resemblance to the products of coöperative scholarship which the enterprise of the modern publisher has made familiar. This type of encyclopædia, with various modifications, prevailed for many centuries and has not yet entirely been abandoned. The first is said to have been compiled by Speusippus (died 339 B.C.), a disciple of Plato; but of his work in this line nothing is known. Among the Romans, Marcus Terentius Varro (died about 27 B.C.) was the first of the encyclopædists, and his *Disciplinarum Libri IX* (Nine Books of Studies) exemplifies well the above-explained connection of the encyclopædia with the liberal curriculum. It was an encyclopædia of the liberal arts—grammar, dialectic, rhetoric, geometry, arithmetic, astrology, music, medicine, and architecture—in nine books, each devoted to one of these special subjects. His *Antiquitates Rerum Humanarum et Divinarum*, in 41 books, dealing with Roman antiquities, civil and re-

ligious, was of a similar character. Neither of these works has survived. The famous *Historia Naturalis* of Pliny the Elder (23-79 A.D.), the earliest of the encyclopædic compilations of antiquity which we possess, approaches more nearly to modern works of the kind in material, but in form does not differ essentially from its predecessors. It is an encyclopædia of natural science, considered especially with reference to human life, and, accordingly, includes geography, medicine, and the history of art. The topics treated in its 37 books comprise the mathematical and physical description of the world, anthropology and human physiology, zoology, comparative anatomy and physiology, botany (including agriculture and horticulture), medicinal zoology, and mineralogy (together with the use of the metals and of precious stones in the arts). It is a mass of facts, often ill digested, collected from a large variety of sources, and is an inexhaustible storehouse of information. About four and a half centuries later Martianus Capella, a native of north Africa—probably of Carthage—wrote an encyclopædia of the seven liberal arts, which in the Middle Ages was extensively used as a textbook in the schools, and which departs even further than those above mentioned from the modern ideal. It is partly in prose and partly in verse, resembling in this the *Satura Menippea* of Varro and the *Satyricon* of Petronius; hence the names *Satura* and *Satyricon* have been given to it. *Satura* (satire) personified is also represented by the author as having inspired the work. Its theme is the marriage of Mercury with “a very learned maiden” (*doctissima virgo*), Philologia (philology), on the advice of Apollo, and the various forms of learning (personified) are introduced in the bridegroom's train. Though for centuries highly esteemed, it is now notable chiefly from the fact that in it the revolution of the planets Mercury and Venus about the sun, and not about the earth, is asserted in a passage which may have suggested to Copernicus his theory of planetary motions. A more important work in 20 books (unfinished), entitled *Etymologiarum (Originum) Libri XX*, with a similar aim, was compiled by Isidore, Bishop of Seville (about 570-636). It deals with the seven liberal arts—medicine, animals, the earth, Old Testament antiquities, etc.—and was long deservedly held in high repute. The tenth book, which is etymological in contents, is arranged alphabetically. Isidore's encyclopædia was rearranged in 22 books, and otherwise edited in the ninth century, under the title *De Universo Libri XXII, sive Etymologiarum Opus* (also known as *De Natura Rerum, De Origine Rerum*, etc.), by another ecclesiastic, Rabanus (or Hrabanus) Maurus (c. 776-856), Archbishop of Mainz. Much of Isidore's material was omitted, and Rabanus' work as a whole shows no advance beyond that of his predecessor. From about the middle of the eleventh century dates a short encyclopædic work in Greek, written in the form of questions and answers, by Michael Constantinus Psellus the younger (born 1020, died after 1105), entitled *Διδασκαλία παντοδαπή*. It treats of divinity, natural history, and various special topics. A more important Greek work, probably of a somewhat earlier date (though it contains quotations from Psellus which may be original), is the dictionary that bears the name of Suidas, about whom nothing is

known. This is a lexicon, in general alphabetically arranged; but it contains, besides definitions of terms, a good deal of biographical, geographical, and historical information, thus suggesting an important characteristic of the modern encyclopædia and also foreshadowing the encyclopædic dictionary of a very recent time. It is an uncritical compilation, but is still very important as a source of information about the literatures and languages of antiquity. A number of valuable critical editions of it have been issued. But the most important of all these early encyclopædias is the great *Bibliotheca Mundi*, or *Speculum Majus*, or *Speculum Triplex* (as it is variously entitled in the manuscripts), of Vincent of Beauvais, a Dominican friar of the thirteenth century. It is a product of indefatigable labor and vast erudition and sums up the learning of its time. It consists of three parts: *Speculum Naturale*, in 32 books, consisting of an account of the creation and the material world, under a great variety of topics; *Speculum Doctrinale*, in 17 books, comprising language (with a dictionary of considerable length), grammar, logic, rhetoric, theology, physics, etc.; and *Speculum Historiale*, in 31 books, consisting of a history of the world from the creation down, with a prophetic forecast of the future, which covers the end of the world (placed in 2376 A.D.), the reign of Antichrist, the Last Judgment, and the renewal of all things. To these a fourth part, *Speculum Morale*, was added by another hand. The author entitled his work *Speculum* (mirror) because, as he said, it reflects everything in the visible and invisible worlds which is worthy of notice—as, indeed, it fairly does for its age. It is professedly a compilation from the earlier literature and is especially valuable for its references to authors. From this time on encyclopædic works of this ancient, discursive, and pedagogical character become more and more numerous, but only the one mentioned: Between 1260 and 1269, Latini (1230–94), a native of Florence, wrote in French *Li livres dou trésor*, a summary of the various departments of philosophy, in the wide sense then assigned to the word. It consists of three books, of which the first treats of the creation, the history of the Old and New Testaments, primitive governments, natural science, and natural history; the second of morals, consisting mainly of translations from the *Ethics* of Aristotle and a popular work called the *Moralities of the Philosophers*; and the third of instruction in rhetoric and of civil government as practiced in the Italian states of that period. This third book is particularly interesting, and the entire work is still valuable in many ways. It was printed in 1474 and several times reprinted. A critical edition of it, by a special commission, was designed by Napoleon I, but the plan was not carried out. In 1550 was published the *Encyclopædia seu Orbis Disciplinarum tum Sacrarum tum Profanarum Epistemon* of Paul Scalich—a survey of the entire circle of science, sacred and profane, notable as the first book to which the title “encyclopædia” was given. In 1630 appeared the *Encyclopædia Septem Tomis Distincta* of Johann Heinrich Alsted (1588–1638), in seven volumes (divided into 35 books), designed to be a methodical summary of all the sciences, and which, though falling far short of its aim, merited the high reputation which it long enjoyed. The second volume contains lists of Hebrew, Syriac, Arabic, Greek, and Latin words

defined in Latin. Lastly, the most extraordinary example of the ancient type is *La science universelle* (1663) of Jean Magnon, an encyclopædic poem designed to fill 10 volumes of 20,000 lines each, but incomplete.

All of the above-mentioned books, and many of their successors in the same class, were more or less unsystematic, or even chaotic, in form and crude in substance. The problem of coordinating or systematizing all the branches of science, which they in some measure at least sought to answer, was, however, a legitimate one, and the attempt to solve it was frequently repeated down to recent times. Bacon's (incomplete) *Instauratio Magna* has been reckoned as the first of these attempts to be made with adequate method and upon genuine philosophical principles. But that work can scarcely be described as encyclopædic, even in this sense. More obviously within this class are numerous works, chiefly German, which appeared mainly in the eighteenth and nineteenth centuries, and which were for the most part written from the point of view of some particular philosophical system, especially the Wolfian, Kantian, and Hegelian. Such, e.g., are *Lehrbuch der Wissenschaftskunde* (1772), *Mug's Versuch einer systematischen Encyclopædie der Wissenschaften* (1796–98); Schmidt's *Allgemeine Encyclopædie und Methodologie der Wissenschaften* (1810); Georg Wilhelm Friedrich Hegel's *Encyclopædie der philosophischen Wissenschaften* (1817).

The transition from this ancient type to the modern was due to a change in form which occurred about the middle of the seventeenth century, and which originated, doubtless, in the desire to make books of this kind more easy of consultation. This change was from the more or less logical arrangement of the material by subjects to its alphabetical arrangement by key words, names, or special topics. In other words, the encyclopædia was assimilated to the dictionary, and from that time on the word “dictionary” (or “lexicon”) has been freely used as the title of encyclopædic works. The change, moreover, was not confined to the form, for the alphabetical arrangement inevitably led to (if its adoption did not spring from) a change in the purpose and character of encyclopædic compilation, viz., that from the exposition of the system of human knowledge to the mechanical arrangement of its contents. The encyclopædia became, in this line of its development, a work of reference in the strict sense of that word—a work for occasional use, in which any particular topic or item of information desired can be found under the proper word in an alphabetical vocabulary. This practical aim and this method—which, as was said above, were exemplified by the *Lexicon* of Suidas—have, however, been adopted by modern encyclopædias in varying degrees. On the one hand, there has been a tendency to approach more and more closely to the dictionary type by increasing the number and variety of the vocabulary words (topics) and correspondingly subdividing the material contained in the book; and, on the other, a tendency (in which the influence of the ancient systematic type is obvious) to restrict the vocabulary and combine the material as much as possible under comprehensive titles. In its extreme form the former tendency has given rise to the modern “encyclopædic dictionary” and such works as the *Grand dictionnaire universel du XIX<sup>ème</sup> siècle* of Pierre Larousse (for both see below), and the latter to encyclopædias which are

little or nothing but aggregations of monographs. These two types—subdivision of material and the collection of it in monographs—are distinct, though no very exact classification of existing encyclopædias can be based upon them, since most of them conform in varying degrees to both. It may be said, however, that encyclopædia makers incline in practice, as well as in theory, more and more towards the adoption of the dictionary type, as better suited to the practical needs of scientific and literary workers and as, in fact, essential to the adequate presentation of the vast accumulations of modern science, history, and biography. In the development of this movement the distinction between the dictionary and the encyclopædia has occasionally been obliterated by the inclusion in the headings of the latter of too many of the common words of the language; it is generally recognized, however, that this should be restricted to those words which can properly be made the theme of encyclopædic articles rather than of mere definitions. As regards the material included in modern works, no general statement can be made that would not be subject to numerous exceptions. Some pay most attention to the sciences and arts, others to history, geography, biography, etc. Others are restricted to some one subject or special group of subjects. During the last three decades a very large number of the special encyclopædias have appeared. Another important characteristic of modern methods is the employment of a large corps of specialists, both as compilers and as editors. Some degree of coöperation of this kind is found in many of the encyclopædias of the seventeenth and eighteenth centuries, notably in the great work of Diderot and D'Alembert (for a description of which see below); but in the nineteenth century it was developed into an elaborate system, necessitated especially by the rapid advance and multiplication of the special sciences. No good general encyclopædia, at least, is now possible which does not include in its editorial staff a small army of men of science, historians, theologians, lawyers, and so on. The aim of its projectors, in a word, is to collect, at first hand, the special knowledge of the time and to present it in a manner that is acceptable to specialists. That this ideal is not always realized need not be said. Lastly, the use of pictorial illustrations—plates and diagrams, and pictures in the text, which found a place in encyclopædias at an early date—has been extended, and their quality has, as a rule, been improved.

The first notable encyclopædia of this class is *Le grand dictionnaire historique, ou le mélange curieux de l'histoire sacrée et profane* (1674) of Louis Moréri (1643–80), in form a special dictionary of history, mythology, genealogy, and biography. It was frequently reissued, was revised and enlarged by various hands, and was translated into English, German, Spanish, and Italian. Moréri's work was marred by many imperfections, and the changes made by its successive editors left little of the original intact. Among those who undertook the labor of correcting its defects was Pierre Bayle (1647–1706), whose *Dictionnaire historique et critique* (2 vols., 1695–97) is the most famous encyclopædic work of the seventeenth century. A second edition, in three volumes, was published in 1702, under the author's supervision; the third (1720), in four volumes, edited by Prosper Marchand, is one of the best. It was subse-

quently often reissued and was translated into English twice (first from the second edition and later from the fifth) and into German. It was in its time an exceedingly valuable book and is still worth consulting. By the simplicity and clearness of its style and its engaging literary qualities it won a permanent place in the history of literature as well as in that of lexicography. Especially notable is its skeptical tone, which made it the object of much theological animosity. Bayle, in fact, changed his religion twice and naturally was not much loved either by Protestants or Catholics. At the same period an encyclopædia of the dictionary type, entitled *Bibliotheca universale sacro-profana*, designed to explain an immense number of words and to cover a wide range of other subjects besides history, biography, and mythology, was undertaken by a Venetian friar, Marco Vincenzo Coronelli. Of the 40 to 45 volumes projected, only seven were issued (1701–06), comprising A, B, and part of C. The book is confused in plan and material, but is notable as the precursor of the great modern general encyclopædias. In England the dictionary method was followed by John Harris (c.1667–1719), who compiled a *Lexicon Technicum; or an Universal English Dictionary of Arts and Sciences, explaining not only the Terms of Art, but the Arts themselves*, published in one volume (1704), and in a second edition of two volumes (1708–10). A supplement "by a society of gentlemen" appeared in 1744. It comprises technical history, geography, and astronomy; definitions of the terms of logic, metaphysics, ethics, grammar, and rhetoric; mathematics, astronomy, botany, etc. The text is illustrated with diagrams and figures. It was long in popular use. In Germany an excellent *Lexicon universale* (2 vols., 1677; with supplement, 2 vols., 1683) was compiled by J. J. Hoffmann. Notable also are the *Reales Staats-Zeitung und Conversations-Lexicon* (1704) and its supplement, *Curieuses und reales Natur-, Kunst-, Berg-, Gewerb-, und Handlungs-Lexicon* (1712), edited by Johann Hübner. They were the products of many hands and together furnish the first example of that systematic collaboration of scholars which characterizes the modern encyclopædia. A still more comprehensive work on this plan is the *Grosses vollständiges Universal-Lexicon aller Wissenschaften und Künste*, edited by Von Ludewig, Frankenstein, Longolius, and others, published 1732–54, in 68 volumes (four supplementary), especially valuable for its . . . . . It is ordinarily known as / . . . . . from its publisher, Johannes Heinrich Zedler, of Leipzig. An English work intrinsically much more important than that of Harris, mentioned above, is Ephraim Chambers's (died 1740) *Cyclopædia; or, an Universal Dictionary of Arts and Sciences, Containing an Explanation of the Terms and an Account of the Things signified thereby in the several Arts . . . and . . . Sciences. . . . Compiled from the Best Authors, etc.*, in two volumes (1728); second (1738) and third (1739) editions during the author's life. It is more comprehensive than Harris's *Lexicon* (though it omits history, biography, and various other subjects) and is of a more scholarly character. The systematic use of cross references, in order to enable the reader to obtain a connected view of general subjects, is especially noteworthy. A supplement, in two



volumes, published in 1753, was based largely upon materials collected by Chambers during the last years of his life. He may be regarded as the father of English encyclopædic lexicography, and he also exerted a wide influence upon continental literature in this department. The translation of his work issued at Venice (1748-49), in nine volumes, was the first completed Italian encyclopædia, while a French translation by John Mills and Gottfried Sellius was the foundation of the famous *Encyclopédie ou dictionnaire raisonné des sciences, des arts et des métiers*, commonly called, *par éminence*, "the Encyclopædia." The task of revising Mills's translation was intrusted by the publishers to Diderot, in whose hands it developed into the production of this original and far more ambitious work. With him were associated a large number of the most distinguished scholars of the age, including D'Alembert (who undertook to edit the mathematical articles and wrote the justly celebrated preface), Rousseau, Daubenton, Mallet, La Chapelle, D'Argenville, Louis, and Blondel. The greater part of the labor, however, fell upon Diderot himself, who was especially charged with the articles relating to the arts and trades as well as those in history and ancient philosophy, and, in addition, undertook the general revision and coördination of the materials contributed by the others. To him accordingly the credit for the result . . . belongs. In form the book is essentially an encyclopædic dictionary, containing both the common words of the language (substantives, verbs, adjectives, etc.) and proper names, accompanied by lexical descriptions and definitions, and also, in most cases, by more or less extended encyclopædic comments. It was designed "as an encyclopædia, to exhibit as far as is possible the order and system of human knowledge, and as a *dictionnaire raisonné* of the sciences, arts, and trades, to contain the fundamental principles and the most essential details of every science and every art, whether liberal or mechanical" (preface). In addition, it was made the vehicle of definite philosophical views, generally radical and in part materialistic, which brought upon it the condemnation of the orthodox and upon its editor much persecution. (See DIDEROT.) This characteristic has given it an important place in the history of modern thought. In this history those who were connected with it or accepted its views are called distinctively "the Encyclopædists." It was published (1751-72) in 28 volumes, including 11 of plates. Five supplementary volumes, with over 200 plates, appeared (1776-77), and an analytical table of contents in two volumes (1780), increasing the total number to 35. Many editions followed, and it was variously modified and supplemented.

In 1781 Charles Joseph Panckoucke (1736-98) published the plan of an *Encyclopédie méthodique et par ordre des matières*, which consisted in breaking up the material of Diderot's work into a series of independent dictionaries of particular subjects, to be compiled by special editors. This scheme, very much enlarged in scope, was carried out (after Panckoucke's death by his son-in-law, Henri Agasse, and Madame Agasse) in a series of 167 volumes, with 51 parts, containing over 6000 plates, completed in 1832. Of these volumes, 7 form a dictionary of zoology, 13 one of medicine, etc. The seed sown by Chambers was

also fruitful in England. His work was re-edited by Abraham Rees (1743-1825) in 1778, and again, with the incorporation of much new matter, in 1781-86, and was finally enlarged by him into the valuable *New Encyclopædia; or, Universal Dictionary of Arts and Sciences*, including biography, geography, history, etc., in 45 volumes (including 6 of plates, published in 1802-20).

As was remarked above, the tendency towards the dictionary type has been accompanied by a tendency towards the opposite (monographic) type. An illustration of the latter is the *Universal Dictionary of Arts and Sciences* (2 vols., London, 1745) of Dennis de Coetlogon, comprising 161 special treatises, arranged alphabetically by their subjects. A more important example is the *Encyclopædia Britannica*, first published in numbers in 1768 and completed (in 3 vols.) in 1771. It was planned by William Smellie (1740-95), a printer, who wrote the principal articles, and an engraver, Andrew Bell. It contained, like Coetlogon's work, distinct treatises and long articles, but also comprised definitions of technical and other terms, in alphabetical order. These general characteristics have been retained by each of the successive editions. Of these, the second was published in 1777-84, and the eleventh (29 vols.) in 1910-12. The so-called *Cabinet Cyclopædia* (133 vols., 1829-49), edited by Dionysius Lardner, is merely an aggregate of essentially independent special works, historical, scientific, etc. An extreme application of the true monographic method is the unfinished *Allgemeine Encyclopädie der Wissenschaften und Künste, in alphabetischer Folge*, edited by J. S. Ersch and J. G. Gruber, which contains articles several hundred, and even thousand, pages in length. It was begun in 1818, and, up to 1914, 168 volumes had been issued.

Since the beginning of the nineteenth century, to which we are brought by this historical review, little change has taken place in the theory of . . . making. The methods by that time established have been variously modified and combined, but not essentially altered. Progress has been made chiefly in the adaptation of methods and materials to practical needs, in the subdivision of the work of compilation and of editorial supervision among specialists, and in the consequent increase of accuracy in detail. There has, however, been a notable growth of the encyclopædic dictionary and of the special encyclopædia. The consideration of the former belongs strictly in the history of lexicography (see DICTIONARY); but several works of this kind fill in large measure the place of the encyclopædia and may be ranked as such. In character such a lexicon (which, as has been shown above, is no new invention) is an approximation of the true dictionary, or wordbook, to the encyclopædia, just as the modern encyclopædia is an approximation of the ancient encyclopædia to the dictionary. These two lines of development have actually met in the *Grand dictionnaire universel du XIX<sup>ème</sup> siècle* (1865-78) of Pierre Larousse in 16 volumes (2 supplementary vols. were added later), and a *Nouveau Larousse Illustré*, 8 vols. (Paris, 1898-1904; supplement, 1907). This is a comprehensive dictionary (etymological and defining) of the French language and at the same time includes proper names and a vast amount of encyclopædic information. Although marred

by many imperfections, it is an exceedingly useful book. Its method has been followed in several other smaller dictionaries, but it cannot yet be said to be approved by lexicographers. Such a complete combination of the two classes of material is regarded, properly, as mechanical and, for other reasons, theoretically objectionable, however useful it may be. It is commonly held, in brief, that the encyclopædia, in encroaching upon the dictionary, should stop at the point where the true work of the latter begins, viz., the systematic collecting of the common words of the language and detailed statement of linguistic usage and history; while the dictionary, in invading the encyclopædic field, should exclude proper names and include only the technical information which is connected with its definitions, strictly so called. This limitation is observed in the dictionaries of which *The Century Dictionary: An Encyclopædic Lexicon* (6 vols., 1889-91; rev. ed., 12 vols., 1911), edited by W. D. Whitney, is the most notable example. The growth of the special encyclopædia has kept pace with the advance of knowledge and of industry. History, the various branches of science and technology, biography, theology, commerce, politics, law, the fine arts, etc., are all admirably represented in special works of this kind. Among the most important are the encyclopædias of biography. Some excellent examples of this class date from the seventeenth and eighteenth centuries; but those produced in the nineteenth century are much more numerous and, in several cases, far more comprehensive. The most notable of these later biographical works are the *Biographie universelle ancienne et moderne* (85 vols., 1811-62, including supplement; 2d ed., 45 vols., 1842-65) of Joseph and Louis Gabriel Michaud; the *Nouvelle biographie générale, depuis les temps les plus reculés jusqu'à nos jours* (46 vols., 1852-66), edited by Hoefer; and the *Dictionary of National Biography* (86 vols.; 1st supplement, 3 vols., 1885-1901; 2d supplement, 3 vols., 1901-11), edited by Leslie Stephen and Sidney Lee.

Some of the more noteworthy general encyclopædias, published during the nineteenth and early twentieth centuries, not mentioned above, are the following: IN ENGLISH: the *Edinburgh Encyclopædia* (18 vols., 1808-30), edited by Sir David Brewster; the *Encyclopædia Metropolitana* (30 vols., 1818-45), edited by Edward Smedley, Hugh J. Rose, and Henry J. Rose—only in part alphabetically arranged; the *Penny Cyclopædia* (29 vols., 1833-46), edited by Charles Knight for the Society for the Diffusion of Useful Knowledge; the *English Cyclopædia* (27 vols., 4 supplementary, 1854-73), also edited by Knight, but on 28 subjects in four divisions; the *Cyclopædia* (10 vols., 1860-68), edited by Andrew Findlater, the new edition edited by David Patrick; *Encyclopædia Londinensis* (24 vols., 1810-29); *Encyclopædia Americana* (14 vols., 1839-47), edited by Francis Lieber; *The American Cyclopædia* (16 vols., 1858-63; new ed., 1895-99), edited by George Ripley and Charles A. Dana; *Johnson's New Universal Cyclopædia* (1874-78; revised, as *The Universal Cyclopædia*, in 12 vols., 1900), the latest edition edited by Charles Kendall Adams; *Blackie's Modern Cyclopædia of Universal Information* (9 vols., 1890), edited by Charles

Annandale; *A Dictionary of Science, Literature, and Art* (3 vols., 1872; new ed. of an earlier work by Brande), by W. T. Brande and G. W. Cox; *The Cambridge Encyclopædia: A Compendium of History, Religion, Chronology, Arts, Sciences, and General Information* (1899-; published monthly); *Nelson's Encyclopædia* (12 vols., 1906-07); *The Americana* (22 vols., 1912); *The International Cyclopædia* (New York, 1884, new eds., 1891, 1894, 1898), now discontinued and superseded by the present work, THE NEW INTERNATIONAL ENCYCLOPÆDIA, in 20 volumes (1902; 2d ed., 24 vols., 1914-).

IN GERMAN: *Brockhaus's Konversations-Lexikon* (1796-1808; subsequently often revised and greatly enlarged; 14th ed., 17 vols., 1 supplementary, 1892-97; again revised, 1901-04), one of the most serviceable and scholarly encyclopædias in any language, especially noteworthy in method as a happy mean between excessive subdivision of material and the monographic type (see above); *Pierer's Universal-Lexikon, oder encyclopædisches Wörterbuch der Wissenschaften, Künste und Gewerbe* (26 vols., 1824-36; 7th ed., 12 vols., 1888-93); *Meyer's Neues Konversations-Lexikon* (37 vols., 1839-52; 6th ed., 1902-08; 3 supplementary vols., 1909-11), a work of much the same quality as that of Brockhaus; *Allgemeine Real-Encyclopädie oder Konversations-Lexikon für das katholische Deutschland* (12 vols., 1846-51; 4th ed., 13 vols., 1880-90); *Wetzer and Welte's Kirchen-Lexicon* (13 vols., 1847-60; 2d ed., 1882-1901).

IN FRENCH: *Encyclopédie des gens du monde; répertoire universel des sciences, des lettres et des arts, etc.* (22 vols., 1833-44); *Dictionnaire de la conversation et de la lecture* (52 vols., 1832-39; supplement, 16 vols., 1844-51; 2d ed., 16 vols., 1851-58; 3 supplementary vols., 1865-82); *Encyclopédie abrégée des sciences, des lettres, des arts, de l'industrie, de l'agriculture et du commerce* (26 vols., 1823-32; new ed., 27 vols., with 12 supplementary vols. and an atlas, 2 vols., 1847-62), edited by Courtin; *Encyclopédie du XIX<sup>ème</sup> siècle répertoire universel des lettres, des sciences et des arts, avec la biographie de tous les hommes célèbres* (28 vols., 1837-59; 2d ed., 1858-64; continued as *Annuaire encyclopédique*), edited by Ange de Saint-Priest; *Dictionnaire encyclopédique universel, illustré de 20,000 figures* (1895-), conducted by E. Flammarion; *La grande encyclopédie: inventaire raisonné des sciences, des lettres et des arts, etc.* (31 vols., 1886-1902).

IN OTHER LANGUAGES: *Nuovo Enciclopedia popolare* (14 vols., Turin, 1841-51); *Dizionario universale di scienze, lettere ed arti* (Milan, 1874), by Lessona and Valle; *Enciclopedia popolare italiana* (ib., 1872), edited by Giovanni Berri; *Enciclopedia universale o repertorio didascalico* (5 vols., Prato, 1868); *Nuova enciclopedia italiana, etc.* (25 vols., Turin, 1875-88), by G. Boccardo; *Enciclopedia moderna* (34 vols., with an atlas, Madrid, 1848-51), by Mellando; *Diccionario enciclopédico Hispano-Americano de literatura, ciencias y artes* (25 vols., Barcelona, 1857-60), by Montaner y Simon; *Diccionario universal de la lengua castellana, ciencias y artes* (3d ed., 15 vols., 2 supplements, with "album," Madrid, 1879-81), based on the plan of Nicolás María Serrano; *Enciclopedia Seguí* (Barcelona, 1907-).

6 vols. to 1914); *Diccionario popular historico geographico, mythologico, etc.* (16 vols., Lisbon, 1876-90), by Chaga; *Diccionario universal portuguez illustrado*, by Zeforina; *Salmonsens's store illustrerede Konversations-leksikon* (19 vols., Copenhagen, 1891-1911); *Geillustreerde encyclopedie: woordenboek voor wetenschap en kunst* (2d ed., 16 vols., Rotterdam, 1884-88); *Nordisk Familjebok* (Stockholm, 1904- , 15 vols. to 1911); *Entsiklopedichesky Slovar* (St. Petersburg, 41 vols., 1890-1904; 2 vols., supplement, 1905-06); *Bolshaya entsiklopedia* (ib., 1901- ; 8 vols. issued); *Encyclopédia Powszechna, etc.* (16 vols., Warsaw, 1898-1904), by S. Orgelbrand.

**ENCYCLOPÉDIE**, ǎn'sé'klô'pâ'dé', ou DICTIONNAIRE RAISONNÉ DES SCIENCES, DES ARTS ET DES MÉTIERS (Fr. *Encyclopædia*, or Classified Dictionary of Sciences, Arts, and Trades). A celebrated French work, published by Diderot and D'Alembert at Paris in 1751-72, which in philosophy, religion, and politics voiced the prevailing tendencies of the time. Among the collaborators were many of the great writers of the day—Rousseau, Grimm, Montesquieu, and Voltaire, in addition to the principal editors. The work aroused violent opposition and encountered many obstacles, its publication being repeatedly suspended by the government, but was carried to completion largely through the secret aid of Madame de Pompadour. It gave rise to the term "Encyclopédistes," by which those who accepted its philosophy were called. See *ENCYCLOPÆDIA*.

**END.** See TELELOGY.

**ENDE**, ɛn'de, HERMANN (1830-1907). A German architect. He was born at Landsberg, attended the Academy of Architecture at Berlin, and afterward made a tour of Europe. He has exercised a considerable influence upon the recent development of architecture in Berlin. The numerous buildings constructed by him (partly in association with Wilhelm Böckmann) include the Red Palace, the buildings in the Zoölogical Garden, Royal York Lodge, Ethnological Museum, and the Bank of Commerce and Industry. The Japanese government intrusted him in 1866 with contracts for the designs of several new public buildings at Tokyo and elsewhere. He was made a member of the Berlin Academy of Arts and honorary member of those of Vienna and St. Petersburg. He was from 1885 to 1901 head professor in the High School for Technical Arts at Berlin.

**ENDEAVOR**, THE. The famous ship in which Lieutenant (afterward Captain) Cook made his voyage of exploration and discovery (1768-71) in the Southern Pacific. It was fitted out by the Royal Society of England for the express purpose of observing the transit of Venus. See *COOK*. CAPT. JAMES.

**ENDECOTT**, JOHN (c.1588-1665). A Colonial governor of Massachusetts, born in Dorchester, England. He was one of the six "joint adventurers" of Dorchester who, in March, 1628, obtained a patent of the Massachusetts Bay Territory, and in the same year led the company of about 100 which, early in September, settled at Naumkeag (later Salem). He acted for a time as Governor, but in June, 1630, was superseded by Winthrop. Endecott then became a member of Governor Winthrop's Council of Assistants. In August, 1636, Endecott led an expedition against the Pequots on Block Island, but accomplished little. He was Deputy

Governor of the Colony in 1641-44; served as Governor in 1644-45; became sergeant major general of Massachusetts in 1645, and from 1649 until his death, with the exception of 1650 and 1654, when he was Deputy Governor, was Governor of the Colony. In 1658 he was elected President of the United Colonies of New England. During his term as Governor he served the interests of the Colony with great ability and energy. He was bigoted, and especially harsh towards the Quakers; but he was a true friend to Roger Williams in his troubles. Consult C. M. Endicott, *Memoir of John Endecott* (Salem, 1847), privately printed, but reproduced in part in vol. i of *The New England Historical and Genealogical Register* (Boston, 1847), and a "Memorial of Governor John Endecott," by Salisbury, in *Antiquarian Papers* (Worcester, 1879).

**ENDEMANN**, ɛn'de-mǎn, WILHELM (1825-99). A German jurist, born at Marburg, Hesse, and educated at Heidelberg. He was professor of law at Jena from 1862 to 1867, assuming in the latter year the same chair at Bonn. From 1871 to 1873 he was a member of the Reichstag. He became one of the greatest authorities on the commercial law of Germany. His works on jurisprudence include: *Der Entwurf eines deutschen Handelsgesetzbuchs* (1858); *Das deutsche Handelsrecht* (4th ed., 1887); *Die Entwicklung des Beweisverfahrens im deutschen Civilprozess* (1895).

**ENDEMIC** (from Gk. ἐνδημος, *endēmos*, native, from ἐν, *en*, in + δῆμος, *dēmos*, people). A term applied to diseases which affect numbers of persons simultaneously, but so as to show a connection with localities as well as with their inhabitants. Endemic diseases are usually spoken of as contrasted with epidemic (q.v.) and sporadic (q.v.), the first term indicating that a disease infests habitually the population within certain geographical limits, and also that it is transferred or communicated beyond those limits only to a limited degree; while, on the other hand, a disease is termed epidemic if it is transmitted without reference to locality, and sporadic if it occurs in isolated instances only. The theory, accordingly, of endemic diseases is that they are in some way or other connected with the soil, the climate, the water supply, the customs of the people, and the microbes natural to the locality. The most marked types of an endemic disease are intermittent malarial fever in many parts of the United States or yellow fever in Brazilian coast districts.

**ENDEMISM** (from Gk. ἐνδημος, *endēmos*, native). In botany, the restriction in area of geographical distribution, commonly resulting from long-continued isolation; the opposite of cosmopolitanism. Somewhat famous cases of endemism are the big trees, or sequoias, of California, which, like most endemic forms, represent the scattered remnants of a former widespread race. Vicarious endemism is the condition in which the dying race, especially if occurring in several disconnected areas, splits up into various species. Relict endemism, on the other hand, is the connection in which a species suffers gradual reduction in area without essential change in specific characters. Still another type of endemism is where new species have arisen by mutation in areas where their migration was restricted. Without knowing the history of the species, this cannot be dis-

tinguished from vicarious endemism. The saxifrages, gentians, and evening primroses, with their local and isolated forms, represent either vicarious endemism or mutation endemism. Relict endemism is well illustrated by the two living species of sequoia, each the last representative of distinct and once world-wide species, and also by the once widely distributed bald cypress. Endemism depends, not upon the size of a district, but upon its barriers—e.g., Germany has no endemic species, while the Alps have 200. Within the United States no region is so remarkable for its abundance of endemic species as California. It has, in addition to the sequoias already mentioned, two cypresses, five pines, and several other conifers found nowhere else in the world. Speaking generally, the longer the isolation, the greater the endemism of a region. See DISTRIBUTION OF PLANTS.

**ENDER**, ɛn'dēr. An Austrian family of painters, all born in Vienna.—**JOHANN** (1793–1854), historical and portrait painter, was a pupil of Maurer and others at the Vienna Academy, where he obtained the great gold medal. He made an early success in painting portraits, almost exclusively in the circles of the aristocracy, and in 1818–19 traveled in Italy, Széchenyi in Italy, Greece, and Turkey. He later lived in Rome and Paris, returning finally (in 1826) to Vienna, where he became celebrated as a painter of miniature portraits, in the manner of Isabey, besides producing a considerable number of historical paintings. From 1829 to 1850 he was professor at the Academy. A "Madonna with the Christ-Child Slumbering at her Feet" is in the Vienna Art Museum; but his best work is a fresco painting of the "Crucifixion" (1850–52), in one of the chapels in the cathedral at Vienna.—**THOMAS** (1793–1875), twin brother of Johann, was a pupil of Mössmer and Steinfeld at the Vienna Academy. He formed his style chiefly after Ruysdael and Claude Lorrain and painted hundreds of so-called "picturesque" landscapes, which are monotonous, but not without charm, and sometimes are effective in color. In 1817 he accompanied the Austrian expedition to Brazil, whence he brought back over 900 drawings and water colors of natural scenery and buildings. In 1819 he went with Prince Metternich to Italy, remained four years in Rome, also visited Palestine and Greece, and in 1826 Paris. He was professor at the Vienna Academy from 1836 to 1852. Of his numerous Austrian mountain landscapes, a "View of the Grossglockner," "The High Göll near Berchtesgaden," "Castle Tyrol," and "Val de Non in South Tyrol" are in the Museum of Vienna.—**EDUARD** (1824– ), son and pupil of Johann, devoted himself especially to historical genre. All his pictures are pleasing in composition, bright in color, but his canvases illustrative of homely life really display greater merits. To the former class belong: "Tasso at the Court of Ferrara"; "Francis I in the Studio of Cellini"; "Shakespeare Reading Macbeth before the Court of Elizabeth"; "Young Mozart Presented to Joseph II"; and of the genre scenes pure and simple, "La Corbeille de Mariage" (1850) and "A Game of Chess" (1857) are among the best.

**ENDERBY LAND**. A region in the Antarctic Ocean, in lat. 66° S., long. 47° 20' to 49° E. (Map: Antarctic Regions, G 3). It was discovered by Captain Biscoe, an English

navigator in the employ of Messrs. Enderby, of London, in 1831, in whose honor he named the land. Innumerable icebergs and impenetrable field ice prevented Biscoe from approaching nearer than about 30 miles. A probable extension (Kemp Land) of Enderby Land to the eastward was discovered in 1833. These lands are doubtless the northern edge of the ice-clad continent of Antarctica. See ANTARCTIC REGION. Consult also Mill, *Siege of the South Pole* (New York, 1905).

**ENDERMIC** (from Gk. *ἐν*, *en*, in + *δέρμα*, *derma*, skin) and **HYPODERMIC** (from Gk. *ὑπό*, *hypo*, under + *δέρμα*, *derma*, skin). Terms used to designate certain methods of making the skin an avenue for the reception of medicines. The endermic method consists in raising a blister by the ordinary process, opening it by a small puncture, which must not be at the lowest part of the bladder, gently pressing out the fluid contents, and then injecting a medicinal solution, by means of a small syringe, through the puncture into the emptied sac; or, if the medicine is in the form of powder, it may be scattered over the raw surface. The endermic method is now superseded by the hypodermic method, in which medicines are introduced into the subcutaneous cellular tissue by means of a very finely pointed syringe. For the invention of this process the science of medicine is indebted to Dr. Alexander Wood, of Edinburgh. See HYPODERMIC MEDICATION.

**ENDICOTT**, MORDECAI THOMAS (1844– ). An American naval officer, born at May's Landing, N. J. He was educated at the Rensselaer Polytechnic Institute (C.E., 1868). In 1874 he was appointed civil engineer in the United States navy. He served as consulting engineer in various navy yards and in the Department at Washington, became a member of the Nicaragua Canal Commission in 1895, of the United States Armory Factory Board in 1897, and of the Isthmian Canal Commission in 1905. He was promoted commodore in 1898 (later rear admiral), and, being appointed chief of the Bureau of Yards and Docks, was reappointed in 1902 and 1906. Although retired in the latter year, he remained in active service until 1909. He was president of the American Society of Civil Engineers in 1911.

**ENDICOTT**, WILLIAM CROWNINSHIELD (1826–1900). An American politician and jurist, a descendant of John Endecott (q.v.). He was born in Salem, Mass., graduated at Harvard in 1847, was admitted to the bar in 1850, and from 1873 to 1882 was a justice of the State Supreme Court. He was a Whig until the dismemberment of that party, when he became a Democrat. In 1884 he was an unsuccessful candidate for Governor and from 1885 to 1889 was Secretary of War in President Cleveland's cabinet. Joseph Chamberlain, the English politician, married Endicott's daughter.

**ENDIVE** (Fr. *endive*, ML. *intiba*, Lat. *intibus*, *intibum*, endive), *Cichorium endivia*. An annual or biennial plant. of the same genus with chicory (q.v.), considered to be a native of the East. It has long been in cultivation as a garden vegetable in Europe and America, its blanched root leaves being much used as a salad and in soups. It is grown like lettuce, on any good garden soil, and is blanched by lightly tying the outer leaves together. In general, those varieties that are most curled, and that naturally begin to blanch before being tied

are in the United States considered to be of a superior quality to the broad-leaved and more persistently green sorts. Many varieties are grown in Europe; among the most popular are the moss-curved, Rouen, and broad-leaved. For illustration, see Plate of SALAD PLANTS.

**ENDLESS SCREW.** A popular name, and one which is not scientifically correct, often given to a screw or helix upon a cylindrical surface which is restrained from motion endwise as it turns, and which meshes or engages with helical teeth on the circumference of a toothed wheel. When the screw (often called a worm in this usage) turns, the wheel is slowly turned. The mechanical combination gives a great reduction of velocity ratio, since one revolution of the screw turns the wheel through the angular space subtended by one tooth. Hence it gives great power, less the losses by friction. It is much used in elevators and in electric hoisting; in the transmission mechanism of electric and other motor vehicles; in fine adjustments for astronomical and other instruments of precision. The screw is only endless because it does not advance or retreat out of the nut or female screw. The latter advances, and not the screw. The worm and wheel are usually on axes at right angles to each other, and the worm in the plane of the wheel. This is not necessary, however. In the Hindley worm the helix is not on a cylinder, but on a hyperboloidal surface, so that more than one tooth of the wheel engages with the helical driving elements. See GEARING.

**ENDLICHER**, ěnt'lik-ěr, STEPHAN LADISLAUS (1804-49). A distinguished Austrian botanist and Sinologist, born at Pressburg, Hungary. He was educated in his native town and at the universities of Pest and Vienna, and entered the church, which career, however, he abandoned after a few years. In 1827 he began his botanical and linguistic studies, and the following year he was placed in charge of the manuscript department of the Imperial Library at Vienna. In 1836 he was appointed curator of the botanical department of the Royal Natural History Museum at Vienna, and in 1840 he became professor of botany in the university and director of the Botanic Garden. Together with Ettinghausen and others, he took a prominent part in the establishment of the Vienna Academy of Sciences. Endlicher's publications were principally upon systematic botany, upon the study of which subject he exerted great influence. Some of his works are: *Flora Posoniensis* (1830); *Grundzüge einer neuen Theorie der Pflanzenzeugung* (1838); *Grundzüge der Botanik*, with Unger as co-author (1843); *Synopsis Coniferarum* (1847). His most important contribution to botany was his elaboration of the natural system of classification of plants, announced in *Genera Plantarum Secundum Ordines Naturales Disposita* (1836-50), and in *Enchiridion Botanicum Exhibens Classes et Ordines Plantarum* (1841). In connection with Hügel and Nees von Esenbeck, Endlicher edited several important botanical works dealing with descriptions of foreign plants preserved in the Vienna Botanical Garden. Endlicher's study of classical and Oriental history and literature resulted in the publication of important contributions to the knowledge of these subjects, among which may be cited: *Anfangsgründe der chinesischen Grammatik* (1845); *Verzeichnis der chinesischen und japanesischen Münzen des*

*kaiserlichen Münz- und Antikenkabinets* (1837); *Analecta Grammatica*, with Eichenfeld as co-author (1837).

**ENDOCARDITIS** (Neo-Lat., from Gk. ěndon, *endon*, within + *kapla*, *kardia*, heart). Inflammation of the endocardium, or serous membrane lining the internal surface of the heart. It may be either acute or chronic, simple or malignant. Rheumatism, tonsillitis, and gout are the most frequent causes of the simple acute form, which generally ends in recovery. Malignant (known also as ulcerative, diphtheritic, or septic) endocarditis is, as these terms imply, due to septic infection, most frequently in connection with scarlet fever, and very fatal. It is characterized by high fever, rigors, and extreme prostration with delirium, convulsions, and death. In the simple forms of endocarditis there is an inflammation with exudation of plastic lymph upon the diseased membrane, particularly that covering the cardiac valves, which become distorted and thickened, giving rise to the so-called cardiac murmurs. This fibrinous deposit may accumulate in masses called "vegetations," which project into the heart cavities. Pieces of these are sometimes dislodged by the blood and carried to the brain or other parts of the body, giving rise to embolism (q.v.). Again, these thickened areas may become atheromatous or may ulcerate. Treatment of the accompanying gouty or rheumatic conditions, and certain medicines, such as digitalis, aconite, morphia, may prove curative, or at least may tide the patient over the acute stage. Few patients recover without resulting valvular trouble. See HEART, DISEASES OF THE.

**ENDOCERAS**, ěn-dōs'ě-ras. An important genus of fossil cephalopods, found abundantly in many species in the Ordovician rocks of Russia, Scandinavia, and the United States. The conch is straight, long, and slender, annulated or smooth. The septa are extended into siphuncular funnels, that reach from the septum of origination to the one next posterior to this. The siphuncle is wide and filled with organic calcareous deposits in the form of cones (endocones). These solid siphuncles of *Endoceras* fill the Beekmantown and Trenton beds. The order of Nautiloidea reaches its largest size in this genus, specimens of which have been found in the Trenton rocks of New York with a length of over 10 feet. The best-known species is *Endoceras proteiforme* from the Trenton limestone. See CEPHALOPODA.

**ENDOCHROME** (from Gk. ěndon, *endon*, within + *chrōma*, *chrōma*, color). The characteristic pigment mixture of diatoms (see DIATOMACEÆ). In a diatom two or more brownish-yellow chromoplasts (color bodies) occur, often called endochrome plates. The endochrome seems to be a mixture of a green constituent (possibly chlorophyll) and a golden-brown constituent (diatomin).

**ENDODERM, ENTODERM** (from Gk. ěndon, *endon*, within + *děrma*, *derma*, skin), or HYPOBLAST. The inner layer of the embryo. See EMBRYOLOGY.

**ENDODERMIS** (Neo-Lat., from Gk. ěndon, *endon*, within + *děrma*, *derma*, skin). In plants, a layer of cortical cells which surrounds the vascular region (stele) (q.v.) as a sheath; also called the bundle sheath. In some cases there is but a single bundle sheath, which surrounds a solitary general vascular region; in other cases there may be several vascular regions in a stem, each surrounded by its own endodermis.

The endodermis is quite variable in its definiteness. Its cells may be indistinguishable from other cortical cells, in which case the name is merely one of position. As ordinarily used, however, the name indicates a layer of cells very different in appearance from the ordinary cortical cells. The corresponding external layer of the stele, against which the endodermis abuts, is called the pericycle (q.v.). See MORPHOLOGY OF PLANTS.

**ENDO'GAMY.** A term correlative with exogamy (q.v.) and meaning enforced marriage within a social or political group. It has been applied to the custom of marrying within, rather than without, the *tribe*, but in this sense the term is of no special value, since there is naturally among most peoples a preponderance of unions between members of the same tribe. Accordingly endogamy is now generally restricted to corresponding regulations applying to tribal subdivisions. One of the best-known illustrations is furnished by the Hindu caste system, while the tendency in civilized society against mating of members of different social strata may be cited as a modern analogue. No one now holds that endogamy represents a stage in the evolution of marriage through which all tribes once passed, and strictly endogamous communities are not nearly so common as those practicing exogamy. Among those of which we have the clearest accounts may be cited the Todas of India, who are subdivided into endogamous moieties, which in turn are subdivided into exogamous gentes; that is to say, an individual must marry within his moiety but outside his gens. It may be noted that endogamous rule applies only to what might be called legal marriage and does not exclude concubinage between members of complementary moieties. Endogamy may arise from different psychological motives. Thus, among the Bella Coola it has nothing to do with pride of blood, but represents the desire to keep certain highly prized traditions the exclusive property of the village community. Consult Rivers, *The Todas* (London, 1906), and Goldenweiser, "Totemism, an Analytical Study," in *Journal of American Folk Lore* (1910).

**EN'DOGENS** (Neo-Lat. *endogenus*, from Gk. *ἔνδον*, *endon*, within + *-γενής*, *-genēs*, producing, from *γίγνεσθαι*, *gignesthai*, to become). An obsolete term formerly applied to monocotyledons (q.v.).

**ENDOMETRITIS.** See UTERUS, DISEASES OF THE.

**EN'DOPAR'ASITE.** A parasite which lives within the body of its host. Among plants the rusts and smuts are common examples of endoparasites, as during the months of vegetative growth the fungi are within the stems of the grain, appearing upon the surface only when their spores are produced. See PARASITE; PLANT PATHOLOGY.

**EN'DOPHYTE, or EN'TOPHYTE** (from Gk. *ἔνδον*, *endon*, or *ἐντός*, *entos*, within + *φυτόν*, *phyton*, plant, from *φύειν*, *phyein*, to produce). A plant which grows inside another plant. See SYMBIOSIS.

**EN'DOR.** A place near Mount Gilboa, in Palestine, where King Saul visited a witch who, by the art of necromancy, raised for him from the dead the prophet Samuel, according to 1 Sam. xxviii. 3-25. In the fourth century A.D. a large town 4 Roman miles south of Tabor bore the name Endor, and a small village 7

or 8 miles from the slopes of Gilboa still possesses it as Endur.

**ENDORSE'** (from OF. *endorser*, ML. *indorsare*, to indorse, from Lat. *in*, in + *doisum*, back). In heraldry (q.v.), a subsidiary, equal to one-eighth or one-fourth part of a pale.

**ENDORSEMENT.** See INDORSEMENT.

**EN'DOSPERM** (from Gk. *ἔνδον*, *endon*, within + *σπέρμα*, *sperma*, seed, from *σπείρειν*, *speirein*, to sow). The nutritive tissue developed within the embryo sac of the seed and used by the embryo. An obsolete term for it is albumen. See SEED.

**EN'DOTHE'CIUM** (Neo-Lat., from Gk. *ἔνδον*, *endon*, within + *θήκη*, *thēkē*, case). A term which has two applications among plants. The endothecium of autheirs is a layer of cells immediately beneath the epidermis, which is usually more or less modified in relation to dehiscence. It received its name from the fact that it is the inner one of the two layers of cells that constitute the wall of the mature anther. The endothecium of Bryophytes is one of the two genetic regions of the spore case, the outer being called amphithecium. The groups of Bryophytes differ as to the products of these two genetic regions.

**EN'DOTHE'LIO'MA.** See TUMOR.

**EN'DOTHELIUM** (Neo-Lat., from Gk. *ἔνδον*, *endon*, within + *θήλη*, *thēlē*, nipple). A tissue which serves as the lining of certain closed cavities and tubes of the body. It covers the serous surfaces of the pleura, the pericardium, the peritoneum, and the synovial membranes of the joints, and lines the entire vascular system, heart, arteries, veins, and capillaries, as well as the lymphatic vessels and spaces. Endothelium consists of a single layer of thin, delicate, platelike nucleated cells united with one another by a small amount of cement substance. The cells differ somewhat in shape and size. Thus, those lining the serous cavities are polyhedral scales resembling squamous epithelium. On the other hand, those lining the blood vessels are long and irregularly spindle-shaped. Recent histological classification places endothelium among the epithelial tissues. See EPITHELIUM.

**ENDOTH'YRA** (Neo-Lat. nom. pl., from Gk. *ἔνδον*, *endon*, within + *θύρα*, *thyra*, door). A genus of fossil Foraminifera, of interest because the minute shells of one of its species, *Endothyra baileyi*, form a large part of the light-gray oolitic limestone of Lower Carboniferous age, known as Bedford limestone. The shells occur by myriads in the limestone associated with fragments of other minute organisms and with oolitic grains of carbonate of lime. See FORAMINIFERA; CARBONIFEROUS SYSTEM.

**EN'DOTROPH'IC.** See MYCOORRHIZA.

**ENDOWED SCHOOLS ACTS.** Acts of Parliament made to prevent misapplication and abuse of the foundations for the support of secondary education in England. Consult Balfour, *The Educational Systems of Great Britain and Ireland* (Oxford, 1912). See NATIONAL EDUCATION, SYSTEMS OF; GREAT BRITAIN, Education.

**EN'DROMIS** (Lat., from Gk. *ἑνδρόμις*; cf. *ἐν*, *en*, in, and *δρόμος*, *dromos*, a running, a race). A kind of boot worn by (ancient hunters and by Artemis, and then by runners (cf. the etymology above) and athletes in general. It was close-fitting and reached some distance above the ankle; the top turned over and hung down in a flap.



The boot was open in the front; on each side of the front were eyeholes, through which the laces were run. The Romans called the endomis of Diana a cothurnus. (See BUSKIN.) The Romans gave the name "endomis" also to a thick woolen rug worn after violent exercise, or used by the lower classes as protection against rain or cold. Such rugs came from Spain and from Tyre.

**ENDYMION** (Lat., from Gk. *Ἐνδυμιών*). According to the Elean story, the son of Aethlios or of Zeus and Calyce. He led the Ætolians to Elis and became King of that country. His grave was shown at Olympia. He was also said to have received from Zeus, at his own request, the gift of eternal sleep with perpetual youth. He was beloved by Selene (the moon), who bore him 50 daughters, i.e., the 50 months of the Olympian cycle. The love of Selene for Endymion, however, is more commonly connected with another form of the story, according to which Endymion was a youthful hunter on Mount Latmos, in Caria; in a cave in that mountain he sleeps forever, visited nightly by Selene, who has given him this sleep that she may kiss him unperceived. Other versions made this sleep a gift of Zeus, as reward for piety, or a punishment for his presumption, when, translated to the gods on Olympus, he had dared to fall in love with Hera. The sleeping Endymion visited by Selene is represented in ancient wall paintings and especially on Roman

Consult Robert, *Antike Sarkophag.* iii (Berlin, 1898); J. E. B. Mayor's note on Juvenal, x, 318 (London, 1888). The story of Endymion is the subject of a poem by Keats.

**ENEMA** (Neo-Lat., from Gk. *ἐνema*, injection, from *ἐν*, *en*, in + *ίεναι*, *hienai*, to send). A fluid substance conveyed into the bowel by injection through the anus. Enemata are used to cause an evacuation of the bowels, or for the introduction of food which cannot be administered by the stomach, or for the administration of medicine. For evacuation of the bowels, an enema of warm water, or soapsuds, or soapy water containing a few drops of turpentine, or olive oil, is used. For nourishment, raw eggs, beef juice, defibrinated blood, or peptonized milk may be introduced. In cases of convulsions, bromides or chloral may be given by the rectum. Enemata are also given to lower the body temperature, to restore the volume of blood which has been lost by severe hemorrhage, and to promote the action of the kidneys. A mixture of ether and olive oil introduced into the rectum is sometimes employed to induce general anæsthesia. In cases of fecal impaction or in some cases requiring nutrient enemata, instead of the ordinary Davidson's syringe or a fountain syringe alone, a long rubber tube must be inserted into the colon first and the syringe attached to this.

**ENEMY** (OF. *enemi*, *anemi*, Fr. *ennemi*, Portug. *inimigo*, enemy, from Lat. *inimicus*, foe, from *in-*, not + *amicus*, friend, from *amare*, to love). In international law, a nation at war with another, considered as a whole or an individual or body of men belonging to the hostile nation. An enemy, in the latter sense of the term, may or may not be a belligerent, but there can in international law be no enmity without the existence of a state of belligerency. Accordingly, no matter how strained the relations of two states may become, they do not

assume the position of enemies towards each other until a state of war arises between them. Nor does the active intervention of a third state or its active sympathy with one of two combatants, even though it be bound to the latter by an offensive and defensive alliance, make it the enemy of the other, until it, too, becomes a party to the war.

An enemy's status in international law depends on whether it is a combatant or a non-combatant. Against the former the whole force of the opposing belligerent state may and should be exerted, with a view to its destruction or subjugation. This is true of the government of the enemy, its civil as well as its military and naval representatives—of all, in fact, who, owing it allegiance, are directly or indirectly engaged in carrying on the war. It is probable, however, that at the present time judges and minor civil servants having no direct connection with the war, as well as diplomatic agents accredited to neutral powers, would be deemed to be non-combatants, though there are modern examples to the contrary.

Noncombatants—i.e., such of the subjects of the enemy state as have no connection with the war, but are engaged in peaceful pursuits—are, by modern usage, exempt from hostile attack. The old theory that, when a state of war existed, each and every subject of the one belligerent was at war with each and all of the subjects of the other, has been superseded in practice by more humane principles. Commercial relations between the subjects of the respective belligerents are, however, suspended, contracts between them are rendered null and void, and the courts of each are closed to the subjects of the other. See ALIEN.

Noncombatants residing in their own country are equally exempt from the worst horrors of war. Though they may suffer incidentally, as the result of the bombardment of fortified places and the destruction, as a matter of military policy, of crops and other property, they are not ordinarily liable to injury either in person or property by any hostile operations. If attacked or plundered by unauthorized acts of soldiers belonging to the enemy, the latter become liable to punishment by their own martial law for violation of the rules of civilized warfare.

The treatment which modern international law accords to combatants will be more appropriately considered in the article on WAR. It will suffice to say here that the mitigation of the horrors of war has not been confined to exempting the greater part of the enemy's population from the list of its victims, but has been extended to the actual conduct of warlike operations on land and sea. It is a marked tendency of modern warfare between civilized nations to confine all public acts of hostility to the actual combatants and to the field of battle.

In their dealings with uncivilized races, however, the Christian nations have not yet reached the same standard of humanity, but continue to confound combatants and noncombatants and to employ against both classes the stern and indiscriminate methods of warfare of a more barbarous age. See ALIEN; BELLIGERENT; WAR; and the authorities there referred to.

**ENERGETICS** (Gk. *ἐνεργητικός*, *energētikos*, active, from *ἐνεργειν*, *energein*, to be active, from *ἐν*, *en*, in + *εργον*, *ergon*, work). The

theory of energy; a theory which states the conditions and laws under which the phenomena of energy are manifested. Energy, pending a more technical definition, may be understood broadly to be a condition or attribute by virtue of which matter can effect changes in other matter.

The modern doctrine of energy, dating from 1840, takes the phenomena of physical science from the position of speculative reasoning or of disconnected and unrelated occurrences and unites them in one general scheme of exact quantitative relationship.

A force applied to a body so as to move it is said to do work, and the measure of the work is the component of the force in the direction of motion, multiplied by the distance through which its point of application moves, or, calling the work  $W$ , the force  $F$ , and the space  $s$ ,  $W = Fs$ . We may interpret this relation from either point of view: if we recognize the force and the distance traversed, we derive the work from their product; if we appreciate the work in the first place, we recognize the force as the relation of the work to the space in which it was performed, since  $F = \frac{W}{s}$ .

Experiment shows that a constant force applied to a body free to move varies as the mass,  $m$ , of the body, and the rate of change,  $\frac{v}{t}$ , in its velocity, and by a suitable choice of units the relation may be stated  $F = m \frac{v}{t}$ , if  $v$  is the velocity produced in time  $t$  by the constant force  $F$ ; furthermore, the space  $s$ , traversed in time  $t$ , while its velocity is increasing from 0 to  $v$ , is  $s = \frac{1}{2} \left( \frac{v}{t} \right) t^2$ . Combining these two

equations we find  $Fs = \frac{1}{2}mv^2$ . That is, a body of mass  $m$ , free to move by the application of a force  $F$ , would acquire a velocity  $v$ , when it had been moved over a distance  $s$ , such that  $Fs = \frac{1}{2}mv^2$ . The expression  $Fs$  is the measure of the action viewed with regard to the agent,  $\frac{1}{2}mv^2$  that with regard to the body; the former is called work, the latter energy. In this particular case, however, the only change that has been produced in the body is a change in its motion, but the body is now possessed of more ability to change other bodies than it possessed before, and in being brought back to its original state of rest or motion it is found to be able either to do mechanical work equal to  $Fs$ , or to confer on other bodies a motion such that the total value of  $\frac{1}{2}mv^2$  for them is exactly equal to that for the given body. This is a simple form of conversion or transference of energy. Energy due to motion only is called *kinetic energy*. The same amount of work might have been done as before, resulting in a static condition of the body upon which work has been done, as, e.g., in compressing or stretching an elastic body; but the body would now be in condition to do work on its own account, i.e., it would possess energy, though not itself in motion. Here a strain has been produced by changing the position of some or all parts of the body. Similarly a body might have conferred upon it power to do work by changing it from one place to another, as when a body is lifted to a point above the earth. It should not be thought, however, that the change in position is the essential feature of the phenomenon; it is

the *visible* portion of it only. Undoubtedly the real seat of the energy is connected with the hidden mechanism which renders it necessary to use a force in order to secure the strain or change in position, e.g., the mechanism of gravitation. Energy due to strain or to position is called *static energy*, or *potential energy*. (The term "energy" is due to Thomas Young, "potential energy" to Rankine, "static energy" to Kelvin.) This affords a more precise definition of energy as the *capability to do work*, and the amount of energy which a body possesses is its *capacity for doing work*. Work, too, may now be regarded as a transference of energy from one body to another. Conceive of a body in a state of strain, as a bent spring, and possessing energy, in consequence of its strain, equal to the work done in bending it. If it is permitted to straighten itself out in part, thereby moving some other body, it does work on this body; and if the only effect is to give it a certain velocity, the kinetic energy the body acquires will exactly equal the work done by the spring. But the spring will now possess less energy, less capacity for doing work, by the amount it has done; the energy it loses equals that gained by the other. The total energy of the two, however, is the same as before. If the two bodies are viewed as comprising a system, the total energy of the system is not altered by any exchange of energy between its parts. We may extend this consideration indefinitely. Given a system of bodies arranged in a definite configuration and with certain stresses between them: if in obedience to these stresses a rearrangement of the bodies takes place, a change of configuration ensues, the energy of the parts may be altered, but the total is not changed. The energy is conserved, and such a system is called a conservative system. So far as known, all material systems are conservative. The energy of such a system is a quantity that can neither be increased nor diminished by any action between the bodies themselves, though the form of energy may be changed. If the total energy is to be increased, it can only be done by work expended upon the system by some external agent, and then the agent loses energy by the amount it expends upon the system. By further extending the same considerations we reach the view that energy cannot be created or destroyed, and that the total energy of the universe is a constant quantity. This is the doctrine of the conservation of energy. Kinetic energy is constantly being changed into potential, and vice versa; but besides the forms in which energy has been mentioned, it exists in a variety of other forms which are not so obviously of a mechanical nature. Both potential and kinetic energy may be classified, as follows:

Potential.	Kinetic.
Strain (extension, compression, or distortion).	Motion (translation or rotation).
Electrification.	Vibration.
Magnetization.	Electricity in motion.
Chemical separation.	Heat.
Gravitative separation.	Radiation.

In all wave motions, i.e., in radiation, energy is transferred from one point to another; and at any instant part of the energy of the medium carrying the waves is kinetic and part potential. In heat phenomena all heat effects are due to the addition or withdrawal of energy from the molecules or small portions of the bodies expe-

riencing the effects; the energy of the minute parts is both kinetic and potential in general. The energy of the parts of a gas is almost entirely kinetic. Motion and strain are the obvious mechanical forms of energy, and their equivalence was early recognized, but energetics to-day involves the statements (a) that energy in any form may be changed into energy of any other form, which is a declaration of the correlation and transformation of energy; (b) that, when energy in any form disappears, an exact equivalent of some other form or forms takes its place, which is a declaration of the conservation of energy; and (c) that, when energy undergoes transformation, or transference from one body to another, the process is not completely reversible, but that if some of the energy is recovered in its original form a residual portion reappears in what is called a lower form. This is the *degradation and dissipation* of energy. Both (a) and (b) are commonly implied in the principle of conservation of energy.

**Historical Sketch.** Although the concept of force as the effort made in doing work, or that of energy as the capability of a body to do work, might either have been made the starting point for a system of dynamics, the former, which was the Newtonian, was first and most completely developed. This seems to have been owing to the fact that force appeals to our so-called "muscular sense," or sense of muscular effort, whereas there is no distinct sense perception of work or energy. When branches of physical science other than mechanics were found to be related to mechanical work with a definiteness that had not before been suspected, the field of energy was widened, and the Huygenian conception became a more familiar one. The first great step of this kind was the recognition of an identity equivalence of mechanical work and of heat effects produced by such work. Experiments by Count Rumford, in 1798, on heat produced by the boring of cannon, and by Sir Humphry Davy, in 1799, on melting of ice by friction, introduced the idea that heat is a form of energy for which there is an exact mechanical equivalent. This proposition, controverting the then accepted theory that heat is material, was too radical to meet with wide acceptance, and the subject received little further development for nearly half a century. It was reasserted by Julius Robert Mayer in a philosophical discussion in May, 1842, but his determination of a definite numerical value for the mechanical equivalent of heat was not made public until 1845. To measure heat, the unit chosen was the "quantity of heat" necessary to raise a unit mass of water one degree in temperature. Taking for the unit mass one gram, and the Centigrade scale for temperatures, the heat unit is called a *calorie* (or sometimes a *water-gram degree*). The unit of work in gravitation measure may be taken as the work of lifting one gram weight a height of one meter, called a gram meter. In the various experiments other units were employed, but we give the results reduced to these. The problem was to determine how many gram meters can produce one calorie and are therefore equivalent to it in energy. This number is called the *mechanical* or, better, the *dynamical equivalent of heat*. It may, of course, be expressed finally in absolute units of work. Mayer's value, 365, was obtained by observing the heat evolved in

compressing air. In January, 1840, James Prescott Joule read a paper before the Philosophical Society of Manchester regarding the thermal and chemical effects of an electric current, which was followed by other investigations in rapid succession, and on Aug. 21, 1843, he communicated to the British Association for the Advancement of Science the result of a most significant investigation, in a paper "On the Relation of Magneto-Electricity, and on the Mechanical Value of Heat." He obtained for the latter 460 gram meters. Then, by allowing the work to be done by weights descending under gravity, and the heat to be produced by the friction of water forced through narrow tubes, he obtained the value 423 gram meters. In November of the same year a Danish engineer, A. Colding, presented before the Academy of Copenhagen the results of experiments upon the heat produced by friction of solid bodies, and expressed the view that the law of conservation of force was a general one. His result for the dynamical equivalent was 370. Although the principle of conservation of energy was suggested almost simultaneously by several physicists, Joule was most indefatigable in the prosecution of his experiments, and within two years he had determined the dynamical equivalent of heat by a variety of methods, the most celebrated of which was the employment of descending weights to drive paddles in a vessel of water, the latter being heated by the friction of the currents in the water produced by the vanes. His paper giving an account of this determination was published in the *Philosophical Magazine* in 1845 and has become classic. In 1847 appeared a discussion of the subject by Helmholtz, entitled "Ueber die Erhaltung der Kraft," which contributed greatly to the establishing of the principle. Between that time and 1860 the whole subject was discussed theoretically and extended experimentally by Helmholtz, Joule, Rankine, Thomson (Lord Kelvin), Clausius, Maxwell, and many others. By 1850 Joule had obtained the value 423.55 gram meters as his best result, and that number stood as the most acceptable value for more than 20 years. In this interval, however, many experiments were made to determine this important quantity by transformations of energy through mechanical, electric, magnetic, and chemical processes, and by 1860 the generally accordant results had not only conclusively demonstrated that heat is a form of energy, but they also demonstrated the conservation of energy. The effect upon scientific investigation was extraordinary. So important a constant is the dynamical equivalent of heat that attempts to determine its value have been made in many ways, including among them various indirect methods in which heat is produced electrically or otherwise than by mechanical work directly; but the most elaborate redetermination by Joule's method of the friction of water by stirring was made in the years 1877 to 1879 by Prof. H. A. Rowland, in Baltimore, Md., U. S. A. His results are, on the whole, the most accurate, and give not only a highly accurate value, but bring out the differences in the value owing to differences in the specific heat of water at different temperatures. They range from 429.8 at 5° C. to 425.8 at 36°, passing through a minimum value of 425.5 at 29°. To express these values in ergs they must be multiplied by 100 times the weight of one gram in dynes at the

place to which the results apply. This weight is numerically equal to the acceleration of gravity in cms. per sec<sup>2</sup>. At Baltimore,  $g = 980.05$ , and Rowland's mean value of the dynamical equivalent from 20° C. to 35° C. is 425.9 gram meters, or  $4.17 \times 10^7$  ergs. The value  $4.2 \times 10^7$  ergs is usually assumed as the mean value, and this is Rowland's value for water at 10° C. The latest determinations give  $4.18 \times 10^7$  ergs for the 20° calorie. The work of lifting one gram a height of 425.9 meters, or 425.9 grams a height of one meter, against gravity, is exactly sufficient to raise one gram of water from 10° C. to 11° C. in temperature.

**Factors.**—Energy can be examined only in connection with matter, and the absolute energy of a body cannot be determined; but the changes of its energy can be determined by the work done upon it to increase its energy, or by the work it does in conferring energy upon another body. In all cases two factors are involved in the physical action, and two factors are required in the mathematical expression. For example, in doing the work, the force employed and the distance over which it moves the object are the physical quantities, and their numerical measures, symbolized by  $F$  and  $s$ , give the product  $Fs$  as the mathematical expression. If this work has been done in producing kinetic energy, the mass of the body and the velocity given to it are the physical factors, and half the product of the mass by the square of this velocity, i.e.,  $\frac{1}{2}mv^2$ , is the mathematical expression. When, however, mechanical work is expended in heating a body, then the factors concerning the latter are its specific heat and its rise in temperature. Bodies taken indiscriminately as to physical conditions of strain, electrification, temperature, etc., placed indiscriminately as to position and left free of constraint, except such as results from these conditions, will not in general remain as placed, but will readjust themselves, by transferences and transformations of their energies, always in a way to reduce the potential energy. In this effort at readjustment lie the origin and nature of all changes in the material world. That substances may exist together as placed, it is necessary that one of the factors of the energy possessed by the bodies shall have the same value in all parts of the system. This factor is called "the intensity of the energy. It is for kinetic energy, velocity; for potential energy, force; for heat, temperature; for electrical energy, electromotive force. Whenever one of these magnitudes has different values at different parts of the system, the latter cannot remain at rest, and the appropriate process takes place." (Ostwald.)

**Potential and Force.** Any region in which work has to be done to move a body from a point A to another point B is called a *field of force*. In such a field the body, when moved from A to B, will gain potential energy equal to the work done upon it and, if allowed to return from B to A by frictionless constraint, will have its potential energy transformed into its equivalent in kinetic energy. The forces of the field may be due to various causes. If to gravitation, the field is called a gravitation field of force; if to electric charges, an electric; if to magnetism, a magnetic field. In every field of force work is done upon the body only if it is of a sort to be affected by the agency in consequence of which the field of force exists.

In a gravitation field it would be matter itself that would be affected; in a magnetic field it would be only a body that would be affected, and . . . Work is expended either upon a body or by it, in bringing it from a point that is without the field to any point in the field, and the amount of energy so required to bring a unit quantity to a given point is called the *potential* at that point. In the gravitation field of force the potential at a point is the work expended in bringing a *unit mass* from infinity to the point; in an electric field it is the work of bringing a *body with unit charge of electricity* to the point. There is, then, a definite potential at a point whether a body is there or not. It is interesting to note that, in Helmholtz's celebrated early discussion of the conservation of energy, the work of transferring any quantity of the kind affected by the field of force from one point to another is the quantity multiplied by the difference of potential between the points. Calling the quantity  $Q$ , and the difference of potential  $V$ , we have work  $= QV$ , which is also the change of energy the body undergoes. But the work is also the product of the average force,  $F$ , by the distance,  $s$ , over which the quantity is transferred: therefore  $Fs = QV$ , or  $F = \frac{QV}{s}$ . This is change of energy per unit distance, or the space rate of change in energy.

The limit which the fraction  $\frac{QV}{s}$  approaches as  $s$  is diminished is the value of the force to move the quantity  $Q$  in the direction of  $s$  at any point. If  $Q = 1$ ,  $F$  is unit force. Unit force, then, might be defined as the space rate of change of potential, and the force upon a body as the space rate of change in energy of the body. This is directly comparable with the Newtonian definition as the time rate of change in momentum. The term "electromotive force," however, is used to express energy, and is equal to and of the same order as the difference of potential it can produce. Since force is the space rate of change in energy, this might be used as a definition of force if the concept of energy precedes it. We might thus dispense with the questionable statement that one body *attracts another*. Two pieces of matter behave as if they attracted each other, but it does not follow that they so attract. We may say, however, that "the part of the energy of a system of two particles of matter of masses  $m$  and  $m'$ , which depends upon their distance,  $r$ , from one another, is measured by  $\frac{mm'}{r^2}$ , and this is not altered by the presence of other particles." (Tait.) This, indeed, represents our whole knowledge of the subject, and the concept force is unnecessary.

**Units.** The same unit may be employed to measure work and energy. In the C. G. S. system the absolute unit of work is the *erg*, which is the work of a force of one dyne, exerted along a path one centimeter in length. In the foot-pound-second system the absolute unit is the foot poundal. In gravitation measure the corresponding units are the gram centimeter and the foot pound. When expressed in the fundamental quantities of length, mass, and time, the dimension of energy in mechanical measure is always of the order of the square of a length, multiplied by the first power of a mass, and

divided by the square of a time, or  $L^2MT^{-2}$ . (It should be noted that the two lengths which enter this expression are in the *same direction*. A moment of a force has the dimensions  $L^2MT^{-2}$ , but the two lengths are at right angles to each other.) By this we may see whether physical quantities represent energy if we observe whether they are expressible in these dimensions. For example, in a gas the pressure per unit area,  $p$ , is of the dimensions  $L^{-1}MT^{-2}$ , and the volume,  $v$ , is of the dimensions  $L^3$ ; then the product  $pv$  has the dimensions  $L^2MT^{-2}$ , and it may be shown that the work done in compressing a gas is the product of the pressure and the change in volume. In heat the unit is the *calorie*, which equals  $4.2 \times 10^7$  ergs. The absolute unit of energy of an electric current is also the erg, but the practical unit is the work of transferring a coulomb of electricity over one volt difference of potential, and is called a volt coulomb, or one joule; its mechanical value is  $10^7$  ergs. The calorie therefore equals 4.2 joules, or one joule equals .24 calorie.

**Dissipation of Energy, Irreversibility, Entropy.** If a body is changed from one state to another by a series of operations, and then, when subjected to these operations in an opposite sense and in exactly the reverse order, the body returns to its first state, the whole cycle of operations is called a *reversible process*. When the transformations cannot be repeated in the reverse order, or if, when reversed, the agencies are not equal in magnitude and opposite in sign to those which occur at the same points in the direct process, the transformation is said to be *irreversible*. According to Planck, the most immediate criterion of irreversibility of a process consists in the proof of a function completely determined by the instantaneous condition of the system, which possesses the peculiarity that it changes during the whole process always in the same sense—perhaps increases. Suppose a body in a state A as to its temperature and quantity of heat, to be changed by any small quantity of heat  $h$  at the temperature  $t$ , the ratio of change in heat to the temperature at which the change is effected being  $\frac{h}{t}$  and let a succession of such changes bring the body to a state B. If, now, changes be effected in the opposite sense in exactly the reverse order, and when the sum of the reversed quantities  $\frac{h}{t}$  equals the sum of the direct ones, the body has regained the state A, the cycle through which it has passed is a *reversible* one. Then "the limit which the sum of the quantities  $\frac{h}{t}$  from the state A to the state B approaches is a constant quantity which depends only on the pressure, volume, and temperature at the state A and the state B, and not all upon the intermediate stages; there is a distinct and measurable physical property of a body, which is characterized by the peculiarity that it increases or diminishes as heat enters or leaves the body, but remains constant when there is no communication of heat. This quantity is called the *entropy*,"  $\frac{h}{t}$  being the measure of change in it. (Hastings and Beach.) Planck shows that electromagnetic radiation, which may now be considered the form in which energy is transmitted through the ether of space,

under conditions termed by him "natural radiation," is attended by a constant increase of entropy in the system of bodies emitting and receiving the rays. By the above criterion, then, such radiation is not a reversible process. Suppose a quantity of heat  $h$  to pass from a body at temperature  $t_1$  to another at the temperature  $t_2$ ; the entropy of the former is diminished by  $\frac{h}{t_1}$ , that of the latter increased by  $\frac{h}{t_2}$ , and since  $t_1$  exceeds  $t_2$ , in order that heat shall so pass, the entropy of the two is greater than at first by  $h \left( \frac{1}{t_2} - \frac{1}{t_1} \right)$ . Therefore all transfers of heat by radiation and conduction in a system of bodies increase the entropy of the system, and hence "the entropy of the universe tends to a maximum." (Clausius.) In any irreversible process, then, a portion of the energy expended in some of the operations cannot be regained for a similar purpose; they are available only for purposes requiring energy of a lower order. No known natural process is exactly reversible, a certain portion of the energy being always dissipated as heat. It follows that, as energy is constantly undergoing transformation, there is a constant degradation of energy to the final unavailable form of uniformly diffused heat.

**Sources of Energy; Matter; Ether.** Of the ultimate nature of energy, as of that of matter, we are ignorant; nor do we know of energy by direct observation, except as associated with matter. It is the change of energy, either as to quantity or form, that is scrutinized and measured, and such change is continually occurring as energy passes from body to body; but the condition of a body totally devoid of energy is a subject of speculation only. Terrestrial energy available to man may be classified as energy of fuel, food, head of water, wind, tides, chemical action, solar radiation. These, with a partial exception in the case of the fifth and sixth, are all traceable to the sun. The earth receives ~~approximately~~ part of the total solar radiation, and the rate at which radiant energy from the sun is expended upon a unit area of the earth's surface is called the solar constant. From tests conducted above the clouds, notably at Mont Blanc and at Mount Whitney, this constant has been determined. From the latter observations Professor Langley concluded "that in view of the large limits of error we can adopt *three calories* as the most probable value of the solar constant; by which I mean that at the earth's mean distance, in the absence of its absorbing atmosphere, the solar rays would raise one gram of water three degrees centigrade per minute for each normally exposed square centimeter of its surface." Subsequent determinations from observations at widely separated stations not only reduced this estimate but show that the rate of emission of energy by the sun fluctuates between maximum and minimum values. Observations under the auspices of the Smithsonian Institution, extending from 1902 to 1913, showed that the value ranged between 1.80 calories and 2.10 calories. The mean value, 1.933 calories per minute per square centimeter, is given by Dr. C. G. Abbott. (Consult *Science*, vol. xxxix, March 6, 1914.) This is  $1.347 \times 10^6$  ergs, or 13.7 gram meters per second to the square centimeter of surface. As this is trans-

mitted at the rate of 300,000,000 meters per second, it represents the energy of solar radiation present in a column of ether near the earth one square centimeter in cross section and 300,000,000 meters in length. Owing to absorption by clouds and the atmosphere, the portion actually reaching the ground surface of the earth is reduced by one-third to one-half.

Although nearly all terrestrial energy may be ascribed to solar origin, the earth also is a radiant body far above interplanetary space in temperature, and various theories have been evolved to account for the maintenance of the sun's heat as well as that of the earth. In the main they imply the conversion of mechanical or of chemical energy into heat. Since, however, it is neither possible nor necessary to postulate any definite total amount of energy in the universe, it is only necessary to find a *competent process* of energy change which will account for the continuance of radiant energy in the face of the enormous rate at which it is dissipated. With the beginning of the twentieth century came the discovery of radioactive substances which emit rays conveying energy with small diminution in the mass of the body from which they proceed. (See RADIOACTIVITY.) To account for this has required an assumption of energy associated with the atom far beyond anything heretofore conceived of, and a profoundly modified view both of the structure of the atom and of transformations of matter has resulted. A theory due to Rutherford and Soddy, that has been used most effectively, is "that the atoms of the radio-elements suffer spontaneous disintegration, and that each disintegrated atom passes through a succession of well-marked changes, accompanied in most cases by the emission of  $\alpha$ -rays," which are the rays associated with heat effects. In the course of disintegration which the atom is thus assumed to be undergoing, the process of radiation from within the substance is attended by an absorption of the radiation in large measure by the body itself, its own temperature being thereby kept higher than that of the medium surrounding it. The heating effect of radium is closely proportional to its radioactivity as measured by the  $\alpha$ -rays. The heat radiated from radium is about 100 gram calories per gram per hour, and from any radioactive matter it is larger in comparison with that due to any known chemical reaction.

It has been suggested that from the radioactivity of the most elemental constituents of the sun, and also from the aggregate radioactivity of substances composing the earth, might come the energy supplied by both the sun and the earth for countless ages. This, like other theories, can as yet be regarded only as a speculation. Two and a half parts in a million, by weight, of radium in the sun would account for its present rate of emission of energy, and the presence of a very small percentage of uranium or other equally active substance distributed throughout the earth would be sufficient even to raise the earth from a cold condition to a hot one. Rutherford shows that the radioactivity of ordinary bodies is of an order high enough to balance the loss of the earth's heat into space. The radiation of energy has of late been much discussed in connection with the subject of relativity, from which the proposition results that the energy sent out by a body does not flow out continuously, but is

emitted explosively in integral numbers of a fundamental unit of energy. This idea is at the base of what is called a *quantum hypothesis* of radiation. See RELATIVITY.

Besides papers cited above, the following works, among many others, are devoted wholly or in part to energetics: Maxwell, *Matter and Motion: Theory of Heat* (London and New York, 1891); Tait, *Recent Advances in Physical Science* (London, 1876); id., *Properties of Matter* (Edinburgh, 1885); Thomson (Lord Kelvin), *Popular Lectures and Addresses*, vol. ii (London, 1894); Dolbear, *Matter, Ether, and Motion* (Boston, 1892); Joule, *Scientific Papers* (2 vols., London, 1884-87); Rowland, *Scientific Papers* (Baltimore, 1902); Tait, *Thermodynamics* (Edinburgh, 1877); Popper, *Die physikalischen Grundsätze der elektrischen Kraftübertragung* (Vienna, 1883); Helm, *Die Lehre von der Energie* (Leipzig, 1877); Planck, *Das Princip der Erhaltung der Energie* (ib., 1877; 2d ed., 1908); Clausius, *Die mechanische Wärmetheorie* (Brunswick, 1876-91); Holman, *Matter, Energy, Force, and Work* (New York, 1898); Nyssens, *Essai de philosophie précise* (Bruxelles, 1908); Ostwald, *Die Energie* (2d ed., Barth, 1912); Soddy, *Matter and Energy* (London, 1912).

**ENERGISM** (from Gk. *ἐνεργός*, *energós*, active, from *ἐν*, *en*, in + *ἐργον*, *ergon*, work). The name given by some recent philosophical writers to the neo-Aristotelian view that the chief end of human life is not pleasure, but due activity of the distinctively human functions, or, generalizing the statement, "the goal at which the will of every living creature aims is the normal exercise of the vital functions which constitute its nature. Consult Paulsen, *System der Ethik* (Berlin, 1894; Eng. trans., 1899). See EUDÆMONISM.

Energism is also the term used to designate the type of metaphysical theory which regards energy as the ultimate reality. Ostwald is the most recent distinguished exponent of metaphysical energism. Consult: Ostwald, *Vorlesungen über Naturphilosophie* (Leipzig, 1905); *Natural Philosophy* (New York, 1910); *Der energetische Imperativ* (Berlin, 1912).

**EN'ERGÜ'MENS** (Lat. *energumenus*, from Gk. *ἐνεργούμενος*, *energoumenos*, demoniac, pres. p. of *ἐνεργεῖν*, *energein*, to work in, from *ἐν*, *en*, in + *ἐργεῖν*, *ergein*, to work, from *ἐργον*, *ergon*, work). A class of persons, suffering from some physical ailment, who in the early ages of the church were believed to be possessed by evil spirits and were placed under the special care of exorcists, yet allowed a certain amount of participation in religious services. Catechumens included in this class could not be baptized, except when at the point of death; while those who became deranged after baptism might be allowed to commune. Both classes had a home in the church and during the services occupied the porch along with lepers and other defiled persons, but at the conclusion of the service received the spiritual benediction.

**ENERGY.** See ENERGETICS; MECHANICS.

**ENERGY OF PLANTS.** The energy relations of the fully autotrophic plants differ somewhat from those of the partially or fully heterotrophic forms, so it is well to discuss the two types separately. In the green plants, as autotrophic forms, the energy exchanges and transformations have been most fully studied in the thin green leaf. The main source



of energy for this organ is radiant energy. In the temperate zone, with direct sunlight, as much as one calorie of radiant energy per square centimeter per minute falls upon the leaf. Of this approximately 0.75 of a calorie is absorbed. A minor source of energy for the green leaf, and probably one of little physiological importance, is that from the surrounding air through thermal emissivity. This exists only when the leaf has a lower temperature than the surrounding air, a condition generally existing in transpiring parts during darkness and in light when the transpiration power of the air is great. The radiant energy absorbed by a green leaf, if transformed to heat and retained as such, is often sufficient to raise the temperature of the leaf 30° C. per minute. From this it is evident that the leaf must have some means, on penalty of life, of dispersing this energy. There are four possible uses of it—vaporization of water or transpiration, photosynthesis, raising the temperature of the leaf, and loss to the air through thermal emissivity. By far the greater part is used in transpiration, photosynthesis consumes from 0.6 to 6 per cent of it, while the amount used to raise the temperature of the leaf or lost by thermal emissivity is generally still less. The latter loss exists only when the leaf maintains a higher temperature than that of the surrounding air, under illumination with transpiration not excessive. Loss of heat by thermal emissivity is thought to be of considerable importance as a cooling factor in desert forms with low capacity for transpiration. The energy rendered potential by photosynthesis can again be released by respiration. The storage of energy in photosynthesis in the green leaf greatly exceeds the release by respiration, and, of course, the same holds for the synthesis and oxidation of carbohydrates. This means a continual accumulation of organic material and energy through the activities of the green leaf. Such a material and energy accumulation is of great cosmic significance, for it renders possible the existence of all heterotrophs, plant and animal, also the existence of non-chlorophyllous parts of the same plant at all times and the chlorophyll parts during darkness. Here, too, we find the source of the energy that is stored in coal, wood, and peat.

The nonchlorophyllous parts of green plants may be considered with the heterotrophs. In the case of heterotrophs the main source of energy is that existing as potential energy in the nutrients taken up. This energy is made available for physiological work by the oxidations involved in fermentation and respiration. A minor source is that taken up by thermal emissivity from the air, a source existing only under conditions mentioned above. The uses made of the energy are similar to those in the green leaves except for the lack of photosynthesis in these forms. Another energy loss is the excretion of incompletely oxidized materials. This might be compared to the loss from the foliage leaf by translocation to other regions of the plant. In all living plants energy manifests itself in the form of osmotic pressure and imbibitional force.

The energy in plants undergoes various transformations conforming to the law of conservation of energy. The potential energy of nutrients is transformed to kinetic energy by respiration or fermentation (q.v.). This, in turn,

may carry on physiological work or become mechanical energy. It may end up as heat, electricity (q.v.), or even light. (See RESPONSE IN PLANTS; PHOSPHORESCENCE.) Similarly the radiant energy (especially certain portions of the light) absorbed by green plants goes through a series of transformations. Some believe it first becomes electrical energy, then chemical energy reducing carbonic acid, and then potential energy stored in the organic foods formed. After that it may go through the transformations mentioned above.

ENESCO, GEORGES (1881– ). A Rumanian composer, born at Cordareni, Rumania, Aug. 7, 1881. When only four years old, he began to play the violin and made such astonishing progress that at the age of seven he was admitted into the violin class of Hellmesberger at the Vienna Conservatory. Here he also studied harmony and counterpoint with Fuchs and tried his hand at original compositions. He remained in Vienna for six years. In 1894 he went to Paris, where he entered the Conservatory, studying violin with Marsick, and composition with Fauré and Massenet. In 1899 he won the first prize for violin playing. As early as 1897 he gave a concert of his own works of chamber music which attracted the attention of Colonne, who in the following year brought out the young composer's *Poème roumaine*. Even these early works show a strong individuality and remarkable inventive power. While still in Vienna, Enesco became infatuated with the works of Wagner and Brahms, who always have remained his ideals and probably saved him from the influence of modern French impressionism. The promise held out by the first works was fulfilled in the later ones, especially in his first symphony in E flat, op. 13 (1909), which carried the fame of its author beyond France into Germany and the United States. His other works include a *Fantaisie pastorale*, a symphony for wind instruments, a suite for orchestra, 3 *Rhapsodies roumaines*; a suite for piano and violin, two sonatas for piano and violin, a quintet for piano and strings. Although he rarely appears as a performer, he is regarded in Germany as one of the foremost violinists. He is also a pianist, organist, and cellist of no ordinary ability.

ENFANTIN, ănfăntin', BARTHELEMY PROSPER (sometimes called PIERRE ENFANTIN) (1796–1864). A French social reformer, born in Paris. He was educated at the Ecole Polytechnique, whence he was expelled in 1814 for complicity in the Montmartre demonstrations of former pupils of the Ecole against the Allies. Subsequently he was connected with banking firms at St. Petersburg and Paris. After 1825 he became a leading representative of the Saint-Simonist teachings. In this rôle he was associated with Bazard. He differed with Bazard, however, on the marriage question in that he openly advocated free love. For this he was sentenced to one year's imprisonment and a small fine. Released after a few months, he went to Egypt, where he could have entered the service of the Viceroy, Mehemet Ali, if he had professed Mohammedanism. After his return to France he became a postmaster near Lyons. He was a member of the scientific commission entrusted by the government with the preparation of a report on Algeria in relation to French colonization. On this subject he wrote *Colonisation d'Algérie* (1843). In 1845 he became a director of the Paris and Lyons

Railway. The volumes *Traité d'économie politique* (1830; Ger. trans., 1905) and *Religion Saint-Simonienne* (1831) constitute his chief published work; his influence depended largely upon his ability as an orator and propagandist. His writings, including his correspondence, appeared with those of Saint-Simon in the Paris edition of 1865-78 (47 vols.). Consult G. Weill, *L'Ecole Saint-Simonienne, son histoire, son influence, jusqu'à nos jours* (Paris, 1896).

**ENFANTS DE DIEU**, ən'fän' də dyē (Fr., children of God). A name given to the Camisards (q.v.).

**ENFANTS PERDUS**, pār'du' (Fr., lost children; Eng. equivalent, "a forlorn hope"). The term is a military expression, meaning the officers and men who were appointed or who volunteered to lead the way in some especially dangerous assault.

**ENFIELD**. A market town in Middlesex, England, 11 miles north of London, noted for its Royal Small Arms Factory, where the celebrated Enfield rifle of the British army was manufactured (Map: London, B 7). (See **SMALL ARMS**.) The town contains the remains of a royal palace in which Edward VI kept his court now used as a school. Isaac D'Israeli was born at Enfield; Keats and Captain Marryat were educated there, and Charles Lamb was a resident from 1827 to 1833. Pop., 1901, 42,700; 1911, 56,344.

**ENFIELD**. A town in Hartford Co., Conn., 15 miles (direct) north of Hartford, on the Connecticut River, and on the New York, New Haven, and Hartford Railroad (Map: Connecticut, E 2). It has carpet factories, steam brickworks, and establishments for the manufacture of undertakers' supplies, filter presses, and shoddy. Enfield has a Carnegie library and is the centre of extensive tobacco-growing interests, and there are several houses engaged in tobacco sorting. Within the limits of the town is a community of Shakers. The government is administered by town meetings. Pop., 1900, 6699; 1910, 9719; 1914 (U. S. est.), 11,006.

**ENFIELD RIFLE**. An army rifle, which derives its name from the place of its manufacture in England. It was invented in 1855 and remained in general use until the adoption of the breechloader in 1867. During the Civil War in the United States (1861-65) many Enfield rifles were used by the United States army, because not enough Springfield rifles could be obtained. It was also in very general use among the Confederate forces.

**ENFILADE'** (Fr., string, from *enfiler*, to thread, from ML. *infilare*, to string, from *in*, in + *filum*, thread). Fire directed at an enemy from the flanks, penetrating his entire length of line. It is the most effective fire possible, owing to the larger target presented. Positions capable of being enfiladed are untenable, no matter what other advantages they may possess. In intrenchments protection against enfilade fire is obtained by constructing *traverses*, banks of earth, at right angles to the line of intrenchment. The English troops in South Africa, in the Boer War of 1899-1901, were frequently enfiladed, the topography of the theatre of operations greatly aiding the Boers.

**ENGADINE**, en'gà-dèn'. A famous valley in Switzerland, in the Canton of Grisons (q.v.), second only to the Valais in length (Map: Switzerland, D, E 2). It extends northeast for over

60 miles along the banks of the Inn, from the foot of Mount Maloja, or Maloggia, to the village of Martinsbruck; area, 653 square miles. It is divided into two portions—that towards the southwest, called the Upper Engadine, which has an average elevation of about 5000 feet, and that towards the northeast, the Lower Engadine. There are numerous glaciers. The climate, while cold, is singularly . . . the Upper Engadine being famous as a health resort, the most frequented place being Saint-Moritz, 6037 feet. The vegetation of the Upper Engadine is abundant and the scenery is remarkably picturesque. The Lower Engadine is narrower, less cultivated, but more picturesque. It is practically unknown to the tourist; most of its villages rest on steep terraces. Pop., 1900, 11,712 (mostly Protestants); 1910, 12,193. The natives speak a Rhaeto-Romanic dialect known as Ladin.

**ENGAGEMENT, MILITARY** (from *engage*, Fr. *engager*, from ML. *invadiare*, to pledge, from *in*, in + *vadium*, pledge, from Lat. *vas*, surety). Active contact with an enemy. The term is generally applied to minor battles, or encounters in which only parts of the contending armies are engaged, or contacts other than a pitched battle. Under modern conditions a battle is, more than ever before, the decisive factor of a campaign, the manœuvring for positions of advantage resulting in engagements of more or less frequency and variety. See **BATTLE**; **STRATEGY**; **TACTICS, MILITARY**.

**EN-GEDI**, ən-gē'dī (Heb. *en-gedi*, fountain of the kid, Ar. *ʿAin-Jidi*). The name of a wilderness, forming the eastern part of the wilderness of Judah, and of an oasis with a spring of warm water on the west shore of the Dead Sea, where at various times a community has flourished (Map: Palestine, E 5). It is assigned to the tribe of Judah in Josh. xv. 62. David fled to the wilderness of En-gedi from Saul and was pursued thither by the King (1 Sam. xxiii. 29-xxiv. 22). In the reign of Jehoshaphat the Ammonites, Moabites, and Edomites gathered here preparatory to invading Judah, according to 2 Chron. xx. 2. The vineyards of En-gedi are referred to in Canticles (i. 14). Pliny (*Nat. Hist.*, v. 17) mentions the place as a ruin in his day, and now the district is tenanted only by a few Arabs of the tribe of the Reshaid. Consult Gautier, *Autour de la mer Morte* (Paris, 1901), and Abel, *Une croisière autour de la mer Morte* (ib., 1911).

**ENGEL**, ɛŋg'el, CARL (1818-82). A German-English writer on music. He was born near Hanover, studied the pianoforte under Hummel, and in 1850 settled in London, where he attained success as a teacher of music and writer on musical subjects. He owned a large collection of rare musical instruments, many of which were given after his death to the South Kensington Museum, with which he had been connected for many years. His books on the history of musical instruments and the ancient nations are standard works. Among them may be mentioned: *The Music of the Most Ancient Nations* (1864); *An Introduction to the Study of National Music* (1866); *Musical Instruments of All Countries* (1869); *Researches into the Early History of the Violin Family* (1883).

**ENGEL, ERNST** (1821-96). A German statistician, born in Dresden. He studied mining engineering at Freiburg and Paris. After act-

ing as member of the Saxon commission for the investigation of industrial and labor conditions, he became in 1850 director of the Royal Saxon Statistical Bureau in Dresden. His work here was mainly in improving the methods of statistics and popularizing the results. In 1858 he resigned to assume charge of the Saxon Mortgage Insurance Company, but returned in 1860 to the public service as director of the Prussian Statistical Bureau. In this office he remained until 1882, when failing health caused him to retire. He was known in professional circles as one of the most capable and energetic of modern statisticians, and his contributions to the methods of administrative statistics were considerable. His investigations into the household expenses of the laboring classes were particularly valuable. Consult *Bulletin de l'Institut International de Statistique*, vol. x (Rome, 1897). Engel's chief works are reprints of contributions to the *Zeitschrift des statistischen Bureau*s and include: *Die Methoden der Volkszählung* (1861); *Land und Leute des preussischen Staates* (1863); *Das Zeitalter des Dampfes* (2d ed., 1881).

ENGEL, FRANZ (1834- ). A German traveler, born at Rüböl, Mecklenburg-Schwerin. From 1857 to 1863 he made a tour through South America, accounts of which he published in the interesting and valuable volumes entitled *Studien unter den Tropen Amerikas* (2d ed., 1879) and *Aus dem Pflanzerstaate Zulia* (1881). He produced the *Landwirthschaftliche Jahrbücher*, vols. i-xxv (1872-96).

ENGEL, JOHANN CHRISTIAN VON (1770-1814). An Hungarian historian, born at Leutschau, Hungary, and educated at Göttingen, where he studied under Heyne, Schlözer, and others. He was ennobled in 1812. His works are thoroughly full of varied and extensive information, and valuable for their time. Engel was a pioneer as regards the history of Hungary. His principal works are entitled *Geschichte des ungarischen Reiches und seiner Nebenländer* (5 vols., 1797-1804) and *Geschichte des Königreichs ungarn* (5 vols., 1814-15).

ENGEL, JOHANN JAKOB (1741-1802). A German dramatist and critic, born at Parchim. He was educated at Rostock, Bützow, and Leipzig, and held various posts, including the directorship (with Ramler) of the Berlin Theatre (1787-94), which was given him on the strength of his essay "Ideen zur Mimik." He wrote much on the theory of art and aesthetics, including, in collaboration with Mendelssohn and others, the *Philosoph für die Welt* (2 vols., 1775-77), and *Anfangsgründe einer Theorie der Dichtungsarten* (2d ed., 1804). His *Herr Lorenz Stark*, a work of fiction first published in Schiller's *Horen* (1801), was distinguished by humor and effective dialogues. Although his dramas are only mediocre, he sympathized with Lessing's efforts to make the German drama a genuine expression of national life. His *Sämtliche Schriften* were published at Berlin (2 vols., 1801-06; new ed., 14 vols., 1851).

ENGEL, JOSEPH (1816-99). An Austrian anatomist, born in Vienna. In 1844 he was appointed to the chair of anatomy at Zurich and subsequently to that of physiology also. He became professor of pathological anatomy at the University of Prague in 1849 and from 1854 to 1874 was a professor of anatomy in the

Josephsakademie for physicians and surgeons at Vienna. His contributions to the development and systematization of anatomical science were considerable. In addition to a large number of uncollected articles, he wrote a *Lehrbuch der pathologischen Anatomie* and a *Kompendium der topographischen Anatomie* (1859).

ENGEL, KARL DIETRICH LEONHARD (1824- ). A German musician and author. He was born in the Grand Duchy of Oldenburg and went to Russia in 1842 as a violin virtuoso. Here he was very successful, and at the age of 22 was appointed a member of the Imperial orchestra at St. Petersburg, of which body he subsequently became concertmaster. In 1869 he settled at Dresden. His writings, principally on the legend of *Faust*, include: *Deutsche Puppenkomödien* (vols. i-xii, 1874-93); *Das Volksschauspiel Doktor Johann Faust* (2d ed., 1882); *Zusammenstellung der Faustschriften vom 16. Jahrhundert bis Mitte 1884* (2d ed., 1884); *Die Don Juan Sage auf der Bühne* (2d ed., 1888). His musical compositions include a concerto in B minor and the unique and humorous fantasy entitled *Jüdischer Carneval*.

ENGELBERG, ɛng'el-bɛrk. A health resort in the Canton of Unterwalden, Switzerland, in the northeast part of the Engelberg valley, 3356 feet above sea level and 14 miles south of Lucerne (Map: Switzerland, C 2). Here is located a Benedictine monastery, founded in 1120, with a library of 20,000 volumes, including many incunabula, besides manuscripts. There is an eleventh-century Catholic gymnasium connected with the abbey. The chief industry is cheese manufacture. Pop., 1900 (including a number of adjacent hamlets), 1976; 1910, 2434.

ENGELBERT, ɛng'el-bɛrt (c.1250-1331). A Benedictine author, born in Völkersdorf, Styria. He was educated at Prague and Padua, and was abbot of Admont in Styria from 1297 to 1327. He is noted chiefly for his Latin history of the Roman Empire, entitled *De Ortu, Progressu et Fine Imperii Romani*, which has been frequently republished. Several of his other productions were published in the *Thesaurus Anecdotorum Novissimus* (1721) and in the *Bibliotheca Asctica Antiquo-nova* (1723-25).

ENGELBERT I, ɛng'el-bɛrt (c.1185-1225). Saint and Archbishop of Cologne. He was born at Berg, of noble origin, was excommunicated in 1206 but reinstated in 1208, and became Archbishop of Cologne at the age of 31. He was one of the foremost ecclesiastical rulers of his day, a patron of agriculture, industry, and art, an excellent administrator, and a sworn enemy to the excesses perpetrated by the feudal barons. He brought about a complete reorganization of the electorate. During the absence of the Emperor Frederick II in Italy after 1220 he was administrator of the Empire as guardian of Henry VII, whom he crowned in 1222 and whom he wished to marry to an English princess. In consequence of an accusation of maladministration which he had brought against his nephew, he was waylaid and slain by hirelings of the latter while on his way to consecrate a church. He was never formally canonized, but he is commemorated as a martyr on November 7. Consult Stoffel, *Engelbert der Reichsverweser* (Elberfeld, 1893).

ENGELBRECHT, ɛng'el-brɛkt, THEODOR (1813-92). A German physician and pomol-

ogist. He was born near Brunswick. He practiced medicine in Brunswick and in 1844 became professor of physiology in the University there. In 1862 he induced the government to establish the Pomological Institute, and he was the first president of the German Pomological Society (1880-89). His principal work is *Deutschland's Aepfelsorten* (1889).

**ENGELBRECHT, THEODOR HEINRICH** (1853- ). A German geographer, born at Obendeich, near Glückstadt, in Schleswig-Holstein, and educated at Leipzig and Strassburg. In 1911 he received an honorary doctor's degree from the University of Breslau. A member of the *Frei-Konservativ* party, he was elected to the House of Deputies in 1895. He wrote: *Die Landbauzonen der aussertropischen Länder* (3 vols., 1898-99), a work of the utmost importance for the study of European agriculture; *Die geographische Verteilung des Getreidepreises* (1903-08), of which the first volume dealt with the United States in 1862-1900 and the second with India in 1861-1905; *Bodenbau und Viehstand in Schleswig-Holstein* (1905).

**ENGELBRECHTSEN, ɛng'el-brekt'sen**, or **ENGELBERTSZ, ɛng'el-berts**, CORNELIS (1468-1533). A painter of the early Netherlands school, born at Leyden. It is not known under whom he studied, and details of his life are lacking. Owing to the destruction of most of his pictures during the Reformation, only two well-authenticated works of large dimensions from his brush remain. These are the altarpieces respectively representing the "Crucifixion" and the "Pietà," in the Museum of Leyden. They are somewhat stiff in composition and dry in color, but show realistic tendencies and a love of the fantastic. Other works, in the museums of Amsterdam, Antwerp, London, Berlin, and New York, have been attributed, with some probability, to him. Engelbrechtsen became known chiefly through his pupils Lucas van Leyden and Aartgen van Leyden.

**ENGELHARD, ɛng'el-härt, WILHELM** (1813-1902). A German sculptor and painter. He was born at Grünhagen, near Lüneberg, Prussia, and studied sculpture at Hanover, with Thorvaldsen at Copenhagen, and with Schwanthaler at Munich. In 1857, at the request of George V, King of Hanover, he executed the famous frieze in the Palace representing the story of the *Waldemar*—a colossal work dealing with the main features of the Saga, rich in sculptural effects. His other works include the "Archangel Michael," at the Military School of Gross Lichterfelde, near Berlin; the "Lorelei," in the Bremen Museum; and the colossal statue of "Odin Enthroned," behind the provincial museum at Hanover. He is represented by other statues at Munich, Rome, Hanover, and Berlin.

**ENGELHARDT, GEORG VON** (1775-1862). A Russian statesman and author. He was born at Riga and at the age of 15 went to St. Petersburg, where, in 1796, he became an employee in the Department of Foreign Affairs. In 1801 Alexander I appointed him Undersecretary of State in the then newly created Imperial Council. In 1811 he became director of the Pedagogical Institute, and in 1816 he was transferred in the same capacity to the lyceum at Tsarskoye Selo, whence, however, he was removed in 1823 because of his pronounced liberalism. He was editor of the *Russische Landwirthschaftliche Zeitung* from 1838 to 1852,

and published *Russische Miscellen zur Kenntniss Russlands und seiner Bewohner* (4 vols., 1828-32) and the manuscript journals of Wrangel the explorer, in the work entitled *Reise langs der Nordküste von Sibirien und auf dem Eismeer* (1839).

**ENGELHARDT, MORITZ VON** (1779-1842). A Russian naturalist. He was born in Esthonia and was educated at the universities of Leipzig and Göttingen and the mining school at Freiberg. In company with Karl von Raumer he traveled through central Europe and in 1811 he undertook a journey through the Crimea and the Caucasus and in 1818 through Finland. The results of the latter tour were published in the work entitled *Geognostischer Umriss von Finland*, vol. i of an elaborately projected *Darstellung aus dem Felsgebäude Russlands* (1821). From 1820 to 1830 he was professor of mineralogy at Dorpat, and in 1826 he entered upon those extensive travels through Russia in the course of which he discovered the vast deposits of gold, platinum, and diamonds described in his famous reports published at Riga in 1828 and 1830. His other literary productions include a description of his first extensive tour, published by him jointly with his companion Raumer in the works respectively entitled *Geognostische Versuche* (1816) and *Geognostische Umrisse* (1817).

**ENGELHARDT, VASSILI PAVLOVITCH, BARON** (1828- ). A Russian astronomer, born in Kustovitchi (Grodno), of an ancient noble family. He was educated at St. Petersburg and in 1847-53 was in governmental service. In 1872 he built an important astronomical observatory in Dresden. In 1903 new buildings were erected at Kazan to house the instruments at Dresden which the Baron gave in 1897 to the University of Kazan. He published *Observations astronomiques faites à Dresde* (3 vols., 1886, 1890, and 1895).

**ENGELMANN, ɛng'el-män, GEORGE** (1809-84). An American botanist. He was born at Frankfort-on-the-Main, was educated at the universities of Heidelberg, Berlin, and Würzburg, and became established as a physician at St. Louis, Mo., in 1835. In 1836 he began the publication of the newspaper *Das Westland*, at one time well known through its excellent descriptions of Western life and manners. It was, however, as a botanist that Engelmann became widely celebrated. Although the greatest authority on the North American vine and cactus, Engelmann also gave considerable attention to other species of plants. His reports of his discoveries and contributions to the government. He was the first president of the St. Louis Academy of Science; and his valuable botanical collection, so important in establishing the nomenclature of numerous botanical species of America, is now in Shaw's Botanical Gardens, St. Louis. His publications include *Systematic Arrangement of the Species of the Genus Cuscuta* (1859) and *The Oaks of the United States* (1876).

**ENGELMANN, ɛng'el-män, JOHANNES** (1832- ). A Russian jurist, born at Mitau, Courland, and educated at the University of St. Petersburg. He was professor of Russian law at Dorpat from 1860 to 1899. After 1887 his lectures, which had previously been given in German, were delivered in the Russian language. These lectures, delivered during a period

of nearly 40 years, covered a wide field and contributed greatly to the advancement of the science of jurisprudence in Russia. His works include: *Die Verjährung nach russischen Privatrecht* (1867; in Russian, 1868); *Die Zwangsvollstreckung auswärtiger richterlicher Urteile in Russland* (1884); *Das Staatsrecht Russlands* (1888).

**ENGELS, eng'els, FRIEDRICH** (1820-95). A German socialist, born in Barmen, Prussia. He was an apprentice at Bremen and Berlin and subsequently became connected with manufacturing interests in Manchester, England. In 1814 he was a collaborator on the *Deutsch-französische Jahrbücher*, issued at Paris by Karl Marx (q.v.) and Arnold Ruge (q.v.). From 1846 he was associated with Marx in the Communistic League, a precursor of the International. Afterward (1848-49) he was an editor of Marx's *Neue Rheinische Zeitung* at Cologne, participated in the revolutionary movement led by Struve and Hecker in Baden in 1848-49, and was a manufacturer at Manchester (1850-69). He was an assistant of Marx in the extension of social democracy and was secretary for Portugal, Spain, and Italy in the general council of the International. Besides collaborating with Marx in the authorship of the famous *Communist Manifesto* and editing the second and third volumes of Marx's *Das Kapital* and the third and fourth editions of the first volume of the same work, he is author of: *Die Lage der arbeitenden Klassen in England* (1845; Eng. trans. by Florence Kelley Wischniewetzky, *The Condition of the Working Classes in England in 1844*, 1887; 1892); *Herrn Eugen Duhrings Umwälzung der Wissenschaft* (1878; 4th ed., 1901; Eng. trans. by Austin Lewis, *Landmarks of Scientific Socialism, "anti-Duehring,"* 1907); *Der Ursprung der Familie, des Privateigentums und des Staates* (1884; 8th ed., 1900; Eng. trans. by Ernest Untermann, *The Origin of the Family, Private Property, and the State*, 1910); *Ludwig Feuerbach und der Ausgang der klassischen deutschen Philosophie* (1888; 3d ed., 1903; Eng. trans. by Austin Lewis, *Feuerbach, the Roots of the Socialist Philosophy*, 1903); *Entwicklung des Sozialismus von der Utopie zur Wissenschaft* (4th ed., 1891; Eng. trans. by Edward Aveling, *Socialism Utopian and Scientific*, 1892, and 3d ed., 1911). Consult: Dawson, *German Socialism* (3d ed., New York, 1899); the biography of Engels by Sembart (Berlin, 1895); Karl Kautsky, *Engels: sein Leben, sein Wirken, seine Schriften* (Berlin, 1895; Eng. trans. by M. W. Simons, *Friedrich Engels: His Life, his Work, his Writings*, Chicago, 1899).

**ENGERTH, eng'ert, EDUARD VON** (1818-97). An Austrian historical and portrait painter. He was born at Pless, Prussian Silesia, and studied under Kupelwieser at the Vienna Academy, where, in 1845, he obtained the grand prize, which gave him six years' study in Rome. In 1854 he was appointed director of the Prague Academy and studied under Kupelwieser at the Vienna Academy; in 1871, director of the Belvedere Gallery, the catalogue of which he published (1862-86); and in 1874, rector of the Academy. His most celebrated picture is entitled "Seizure of King Manfred's Family after the Battle of Benevento" (Art Museum, Vienna). The colossal painting entitled "The Victory of Prince Eugene at Zenta" (Imperial Castle at Ofen) was also very popular, although somewhat conventional in conception. Engerth frescoed the church at

Alt Lerchenfeld after the cartoons of Führich, painted numerous portraits, and decorated the new Vienna Opera House with a series of paintings from "The Marriage of Figaro" and "Orpheus."

**ENGERTH, WILHELM, BARON** (1814-84). An Austrian engineer, brother of the preceding. He was born at Pless, Prussian Silesia, studied architecture at the Polytechnic Institute and at the Academy of Arts, Vienna, and in 1844 was appointed professor of mechanical engineering at Gratz. He is inventor of the "Engerth system" for freight locomotives, which, since its introduction on the Semmering Railroad, has found wide adoption on the Continent. The river gate near Nussdorf, which prevents the entrance of ice into the Danube Canal at Vienna and the resultant annual inundations, was devised and built by Engerth. He was architect of the buildings of the Vienna Exposition of 1873, and the entire engineering department was on that occasion placed under his control.

**ENGHIEN, an'gyän', LOUIS ANTOINE HENRI DE BOURBON, DUC D'** (1772-1804). A member of the Bourbon family, celebrated in history for his tragic fate. He was the only son of Prince Louis Henri Joseph de Bourbon and the grandson of the Prince of Condé and was born at Chantilly, Aug. 2, 1772. In 1789 he left France and traveled through several countries of Europe. In 1792 he entered the corps of *émigrés* (q.v.) assembled by his grandfather, the Prince of Condé, on the Rhine. After the Peace of Lunéville in 1801 he went to reside at Ettenheim, an old castle on the German side of the Rhine, not far from Strassburg and within the territories of the Duke of Baden. Here he married the Princess Charlotte of Rohan-Rochefort and lived as a private citizen. When the conspiracy headed by Cadoudal and Pichegru against the life of Bonaparte was discovered at Paris (1804), the police were led to believe that the Duc d'Enghien was privy to it, and the evidence seemed at first to justify their belief. The unfortunate error of a spy further tended to confirm the strong suspicions of Bonaparte, and he resolved to seize the person of the unfortunate Prince and make of him a terrible example for future conspirators. On the night of March 15, 1804, the neutral territory of Baden was invaded, and the Duke captured and carried a prisoner to Vincennes. On March 20 he was tried before a court-martial consisting of eight officers and after a brief examination was condemned to death. Although the evidence had established his innocence, Napoleon had determined that he should die. The grave of the victim had been prepared in expectation of this sentence, and at three o'clock on the morning of March 21 he was shot. His innocence was soon established beyond doubt, and the execution of the Duc d'Enghien has fixed a deep and lasting stigma on the character of Napoleon. The diplomatic effect of the execution was further unfavorable to Napoleon. The Czar of Russia sent an indignant protest to Paris, to which the First Consul responded that the internal affairs of each country were its own concern. A complete rupture of diplomatic relations followed. The reluctance of the Pope to officiate at Napoleon's coronation soon afterward was due in great measure to the horror excited by the unjustified execution of the Duc d'Enghien. Consult: Dupin, *Pièces judiciaires*

(Paris, 1823); id., *Mémoires historiques sur la catastrophe du duc d'Enghien* (ib., 1834); Constant, *Le duc d'Enghien* (ib., 1869); Welschinger, *L'Europe et l'exécution du duc d'Enghien* (Amiens, 1890); Nongarède de Fayet, *Recherches historiques* (2 vols., Paris, 1844); *Correspondance du duc d'Enghien, 1801-04* (ib., 1904); Comte Bonlay de la Meurthe, *Les dernières Années du duc d'Enghien* (ib., 1886); Ropes, *The First Napoleon* (Boston, 1885); Fay, "The Execution of the Duc d'Enghien," in *American Historical Review* (New York, 1891).

**ENGIDU**, en'gi-doo. A character in the Babylonian Gilgamesh epic, represented as half man, half bull. Aided by his prowess and strength, Gilgamesh slays Khumbaba, the Elamite, who has usurped the throne of Erech. But Gilgamesh has scorned the love of the goddess Ishtar, who in revenge inflicts upon him a disease and puts Engidu to death. Ea grants the desire of Gilgamesh to see his friend Engidu once more and causes Nergal to let Engidu's ghost rise "like vapor from the earth and make known to his brother Gilgamesh the law of the earth." See GILGAMESH, and consult Ungnad, *Das Gilgameschepos* (Tübingen, 1911), and Jastrow, *Hebrew and Babylonian Traditions* (New York, 1914).

**ENGINE**. See STEAM ENGINE; INTERNAL-COMBUSTION ENGINE.

**ENGINEER, MILITARY**. See ENGINEERS, CORPS OF; ENGINEERING, MILITARY.

**ENGINEER, NAVAL**. In the United States navy the care and operation of all machinery are assigned to line (or executive) officers. The first step towards the organization of a corps of engineers was taken by the appointment of Mr. C. H. Haswell (q.v.) as chief engineer of the *Fulton*. His appointment bore date of July 2, 1836. For some years afterward engineer officers were appointed by the commanding officer of a ship and could be dismissed at his pleasure. But in 1842 Congress passed an Act by which chief engineers were commissioned as officers of the regular navy and the assistants were made warrant officers. In 1845 a supplementary Act transferred the appointing power to the President, as in the case of other officers. The number of engineers increased with the development of steam engines, reaching 2277 in January 1865—1803 volunteers and 474 regulars. The Bureau of Steam Engineering (see STEAM ENGINEERING, BUREAU OF) in the Navy Department was established by the Act of July 5, 1862.

In 1863 the officers of the Engineer Corps petitioned Congress to establish a course of instruction for cadet engineers at the Naval Academy, and this was provided in the Act of July 4, 1864. Several officers graduated; but after a short time the instruction was dropped until 1871, when a regular course of two years was established. This was changed to four years in 1874. The Act of Aug. 5, 1882, amalgamated the cadet midshipmen and cadet engineers under the title of naval cadets. From that time until the Act of March 3, 1899, naval cadets were divided into line and engineer branches at the end of three years, pursuing the higher special studies of their respective branches chiefly in the last year. The Act of 1899 consolidated the engineer corps with the line. The older officers were required to perform engineering duty only, the younger ones to qualify in both branches. The same Act

established the grade of *warrant machinists* (name since changed to *machinists*). Machinists (q.v.) perform watch standing duty on smaller ships and act as junior assistants on the larger ones.

Officers desiring to specialize in engineering are given an advanced course at the Engineer Postgraduate School at Annapolis or at some university. All line officers are required to perform engineering duty and to be competent to stand a watch or act as senior engineer of a ship. But only those who have had more than average experience as assistants are ordered as senior engineers. In the future it is expected that senior engineer officers and designing engineers will be selected chiefly from officers who have taken the postgraduate course in marine engineering.

The amalgamation of the Engineer Corps and the line, though much criticized and for a short time operating with some difficulty, is now a pronounced success. The efficiency of the machinery of all kinds in the war vessels of the United States has never been so high as at present. And the knowledge of the conditions in the engine room, fire room, and dynamo room possessed by deck and commanding officers adds much to the certainty and intelligence with which they are able to carry out their duties.

In European navies the necessity of giving deck and commanding officers a competent knowledge of machinery is being more and more appreciated, and several have taken steps in this direction, though none have yet gone so far as the United States.

**EN'GINEER' AND EN'GINEERING**. Engineering at the present day may be broadly defined as the practical application of science and scientific methods to industry. Historically engineering is one of the oldest of the professions. The military engineer became a necessary aid in warfare when siege was laid to a fortified stronghold and the attacking force had to advance earthworks over and tunnel under ground exposed to the enemy's fire. The direction of these tunnels, in order to reach a desired point, had to be fixed by an engineer. Early work of this sort was a development of the ancient art of land surveying, and down to the present day surveying has been an important part of the engineer's work. The engineer in charge of the earthworks for attack and defense also had doubtless the responsibility for constructing and operating the military engines of that period. Hamlet's lines, "For 'tis the sport to have the engineer hoist with his own petar," indicates the probable significance of the word "engineer" as late as Shakespeare's day.

Engineering, as defined above—the application of scientific methods to industry—may be said to have had its beginning in the field of transportation. The location of canals required the services of engineers who could apply the methods of surveying developed by the military engineer to the running of lines and levels. The term "civil engineer" accordingly was coined to distinguish those engaged in this work from the older branch of the profession engaged in military operations. It was very early perceived, however, that the engineer was destined to become much more than a mere measurer and computer or even a constructor. Thomas Tredgold, the famous English engineer, in the charter of the Institution of Civil En-



gineers, which he founded, defined engineering as "the art of directing the great powers of Nature for the service of Man."

The development of the modern profession of engineering may be said to have begun with the railway era. In 1829 George Stephenson's locomotive, the *Rocket*, attained a speed of 44 miles per hour in the competitive trials on the Liverpool and Manchester Railway. Immediately thereafter the construction of railways was undertaken in all civilized countries. The services of engineers were at once necessary to locate the railway line and the structures along it, and to measure the excavations and embankments in order to pay the contractors for the work performed. Railway building has ever since been an important branch of engineering work.

An excellent illustration of the evolution of the engineer from the mere measurer to the man who applies skilled judgment and experience to the solution of the highest economic and financial problems is furnished by this very work of railway location. A. M. Wellington, in the Introduction to his *Economic Theory of Railway Location*, said: "It would be well if engineering were less generally defined as the art of construction. . . . To define it rudely but not inaptly, it is the art of doing well with one dollar what any bungler can do with two after a fashion." The same idea was expressed more tersely by E. H. McHenry, who said (referring also to railway location): "Engineering is the art of making a dollar earn the most interest."

To comprehend the significance of these definitions, it should be understood that the locating engineer can vary the first cost of a railway within wide limits at the expense of its annual cost for maintenance and operation. Knowing the volume of traffic to be handled, the ruling rate of interest on capital, and the effect of varying rates of grade and curvature on the cost of haulage, it can be determined what line will yield to its owners the largest net earnings or, if the road is a government enterprise, what line will give the lowest cost per ton of freight and per passenger handled. These and similar problems are solved by the engineer, not as a mere matter of mathematics, but as a matter requiring the exercise of the most careful judgment and a forecast of the future as well.

That the skilled engineer is able successfully to forecast the future in the solution of his problem is admirably illustrated by the Panama Canal work. Perhaps the largest engineering problem ever presented in point of expenditure involved was the question whether that canal should be built with locks or at sea level. In comparing the two plans one essential element was their relative cost. The United States Isthmian Canal Commission of 1899, which recommended the Panama route for adoption, estimated that the cost of digging the great Culebra Cut on the line of the canal, containing nearly 100,000,000 cubic yards of rock, the largest piece of excavation ever undertaken, would be 80 cents per cubic yard. The actual cost to the government up to Jan. 1, 1914, when the cut was practically completed, had been 78.18 cents per cubic yard.

While the term "civil engineering," as noted above, was originally used to distinguish the engineer surveyor who located such public works as railways and canals from the engineer who

applied similar methods to military works, that significance has long been obsolete. Civil engineering at the present day relates to works in connection with transportation, such as railways, canals, and roads, to works which have to do with water, such as public water supply, irrigation, drainage, and sewerage, to works of river and harbor improvement, and to structural works, such as bridges, buildings, dams, piers, docks, etc. In all these fields of work the adoption of scientific methods of design, construction, and operation in place of the methods of the craftsman or guild worker marks the advent of the engineer.

The development of mechanical engineering, which has occurred almost wholly during the past 40 years and chiefly during the present century, means that the art of machinery design and construction has passed from the millwright and machinist to the engineer. Mining engineering is another one of the grand divisions of the profession, including all the work in connection with the exploration for, and the development and mining of, ores, coal, and minerals; while electrical engineering deals with the design, construction, and application of all classes of electrical machinery and apparatus.

Each of these four principal divisions of the profession includes a large and rapidly increasing number of specialties. Mechanical engineering, e.g., includes such specialties as heating and ventilating engineering, automobile engineering, steam engineering, gas engineering, etc. Civil engineering includes structural engineering, sanitary engineering, hydraulic engineering, railway engineering, etc. It would be easy to make a list of 100 or more different specialties in engineering work which are well recognized. The list is constantly increasing as new industries arise and the technology of their processes becomes systematized.

On the other hand, there are many engineers of high standing who do not specialize at all, but act as technical executives and employ and direct the work of civil, mining, mechanical, and electrical engineers to carry to success a great work of construction or conduct a huge manufacturing or mining industry. It is also true that there are no hard and fast lines between even the great divisions of the profession. Many civil engineers have at times done important work in mechanical engineering, e.g., and engineers are constantly changing from one specialty to another as circumstances make necessary. Such transfers are facilitated by the fact that all engineering is based, broadly speaking, on mathematics, physics, and chemistry. Other sciences are also made use of in some branches, such as geology in the work of the mining engineer and botany by the agricultural engineer.

In schools of engineering the courses of study prescribed in civil, mechanical, or other branches of engineering are generally the same for the first two years at least, and many leading educators favor a single four-year course of study for all engineering students, leaving specialization to a postgraduate course or to practical experience. (See TECHNICAL EDUCATION.)

The question as to the number of persons engaged in engineering work cannot be answered by any census statistics. The name "engineer" is applied in the United States, not only to those practicing the engineering profession, but to those operating steam and other engines,

such as locomotive engineers and stationary engineers. In England both the firms operating machine shops and their employees working at the machinists' trade are called engineers. In the engineering profession itself there is no authoritative definition as to what constitutes an engineer. There is no legal restriction upon the practice of engineering in the United States; and while in recent years there has been agitation for such legislation, a large proportion of the profession opposes it.

The best idea as to the probable number of professional engineers in the United States is obtained from the statistics of the engineering societies. The four great American societies of civil, mechanical, mining, and electrical engineers now have a total membership in the United States of 25,000. Admission to these societies is generally conditional upon the attainment of a fair degree of professional standing and experience. Hence the number of men engaged in professional engineering work in subordinate capacities such as draftsmen, instrument men, inspectors, etc., must be several times as great as the membership of these societies. Besides these great national societies, there are between 200 and 300 other societies of engineers, many of local character including the engineers of a city or State, and others devoted to some special branch of engineering work.

The reaction in college education from the classical and literary studies towards the study of applied science has been partially responsible for the enormous increase in the number of engineers in the past quarter century and for the overcrowding of the profession which now exists, notwithstanding the many new fields which have been opened to the engineer in that time.

Besides the graduates from the engineering colleges, the lower ranks of the profession are constantly recruited by men who have gained their engineering knowledge by practical experience, supplemented often by home study with the aid of a correspondence school. Since good judgment based on practical knowledge is the most important requisite to an engineer, those who enter the profession in this way often attain a good degree of success, although they necessarily labor under a handicap compared with engineers who have made the most of their opportunities for study at a first-class engineering school.

The consolidation of industries has had a marked effect on engineering work, and the present tendency is for such work to gravitate into the hands of strong engineering firms, employing on a salary a staff of engineers numbered perhaps by hundreds. Probably at least 5 per cent of the engineers of the United States work at a salary, either for some engineering or manufacturing firm or in city, State, or Federal service. The engineers who carry on private practice are commonly termed consulting engineers, although in nearly all cases they engage in design and construction as well as in the work of investigation and advice properly termed consulting.

The increasing complexity of industry makes the engineer expert more and more a necessary factor, not only in carrying on industrial processes, but in the governmental supervision of industry now so rapidly extending. The New York Public Utilities Commissions have a staff

of engineers numbered by hundreds. The Interstate Commerce Commission requires many hundred engineers in the task of valuing the railways of the country which it has undertaken. Engineers have been chosen as the executive heads of many great railway and industrial corporations, and in nearly every instance an engineer has been selected to fill the new position of city manager in the cities which have adopted that form of municipal government. It is generally recognized by the profession that the advancement of its leading members to high positions of responsibility is due, not only to the ability and experience of the men so promoted, but to the high character that the profession as a whole bears for fidelity to the trusts imposed upon it. The profession is therefore laying greater stress than ever upon the observance of proper ethical conduct by its members.

**ENGINEER CORPS**, *kör*, UNITED STATES NAVY. See **ENGINEER**, NAVAL.

**ENGINEERING**, MILITARY. Military engineering in its broader sense is the application of engineering to military purposes. The term was thus used originally to distinguish it from civil engineering. In recent years there has been such marked advance in certain branches of civil engineering (see **ENGINEER AND ENGINEERING**) as to entitle them to the rank of separate professions; as, e.g., surveying, sanitary engineering, mechanical engineering, and electrical engineering. The mechanical military engineering connected with the development of guns and carriages has been gradually developed into the art and science of ordnance (q.v.). Military signaling is now carried on in several armies either by signal corps or by detachments of engineer corps having practically no other duties to perform. (See **SIGNALING AND TELEGRAPHING**, MILITARY.) On the other hand, many of the problems presented to the military engineer are of such nature that they are solved by direct applications of sanitary engineering, mechanical engineering, surveying, general civil engineering, electrical engineering, and architecture, with only slight modifications caused by the military conditions imposed on them. Such, e.g., are topographical surveys preliminary to the designing and construction of permanent fortifications, barracks, and other buildings for the service of troops in time of peace, and water supply and drainage of military posts. In its more restricted sense, therefore, military engineering is now taken to include, on the one hand, those applications of the various branches of engineering to military purposes where the military conditions are paramount, and, on the other, to those operations connected with the movements of an army in all that pertains to attack and defense, and to the design, location, and construction of permanent works of land and seacoast defense more commonly known as fortifications. The subject is generally considered as being divided into, first, military field engineering; second, permanent land and seacoast defense. The present article will deal chiefly with certain features of field engineering, while reference will be made to separate articles which discuss the other important field duties of the military engineer. The subject of land and seacoast defenses is treated under the title **FORTIFICATION**.

**Military Field Engineering** comprises primarily those applications of engineering to the problems of an army in the field, where the prime

elements to be considered are the amount of time available, the nature of the labor, and the material at hand. From the nature of the movements of large bodies of troops, it is impracticable to carry much material in addition to what is required for the maintenance of the army on the simplest basis. Field engineering, therefore, to be successful must rely largely on the resourcefulness of its representatives. The military engineer who can secure a result sufficiently good to answer the purpose in the time allowed will be more successful in the field than one of greater attainments whose temperament prevents him from taking short cuts and from being satisfied with any work short of perfection. Under the head of military field engineering the following divisions of the subject may be made: field measurements, clearing of land, encampments, military surveys and maps, communications, field fortification, siege works, and military mining.

Of the topics included in this division of the subject, field measurement, clearing of ground, military surveys, topographical reconnaissance and maps, being more or less closely related, will be described in the present article, while separate articles to which the reader is referred will treat the subjects of ENCAMPMENT; ROADS AND RAILROADS, MILITARY; BRIDGES AND DOCKS, MILITARY; DEMOLITION; MINES AND MINING, MILITARY; SIEGE WORKS; FORTIFICATION.

**Field Measurements.** The rapid approximate measurement of distances is frequently necessary in field operations. For short distances resort is had to the use of the rule and tape. For longer distances, where both extreme points are accessible, measurement is ordinarily made by pacing, running over the line with a wheel, or by estimation with the eye. With practice many officers become extremely expert in the determination of distances by the eye. Where the distance to some inaccessible point, as, e.g., a tree on the opposite bank of a river, is required more accurately than would probably be given by simple estimation, a method

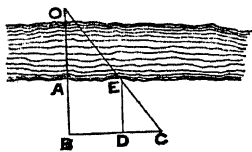


FIG. 1.

in the line  $BC$ , as  $D$ , lay off a line at right angles to  $BC$ . Mark the point  $E$  where the line of sight from  $C$  to  $O$  crosses  $DE$ . Then, by similar triangles, having measured  $DE$ ,  $DC$ , and  $CB$ , we shall have  $BO : BC :: DE : DC$ . Therefore,

$$BO = \frac{BC \times DE}{DC}.$$

By a similar but slightly more complicated process, the height of a distant inaccessible point can be determined. Other simple and practical methods for measuring similar distances are described in the field-engineering manuals. A simple way of laying out a right angle in the field is as follows: To lay out a right angle to the line  $AD$  at the point  $A$ , measure the distance  $AD$  equal to four convenient units, as feet or yards; then

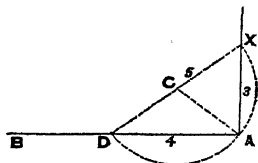


FIG. 2.

taking one end of a tape held at  $D$  and the other at  $A$ , tighten the tape so that the distance  $XD$  shall be equal to 5 units and  $XA$  to 3. The angle  $XAD$  will be a right angle. By bisecting this angle one of  $45^\circ$  can be obtained: by trisecting the latter, one of  $15^\circ$ , etc. To lay off an angle of  $60^\circ$  proceed as follows: At the point  $E$  on the line  $AEB$ , hold one end of a tape, and with any length, as  $EB$ , describe the arc of a circle, as indicated in the cut; with the other end at  $B$  and the same radius describe a second arc intersecting the first. From the point of intersection  $D$  draw the line  $DE$ ; the angle  $DEB$  will then be  $60^\circ$ . By bisecting this angle one of  $30^\circ$  can be obtained; by bisecting this, one of  $15^\circ$ ; etc.

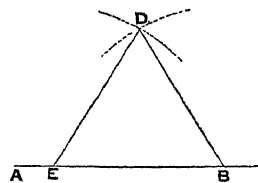


FIG. 3.

**Clearing of Ground.** Various reasons frequently render necessary the clearing of ground in the field. In the case of a position definitely taken up with a view to battle, it is eminently desirable that as much of the ground to the front as lies within rifle range should be cleared so thoroughly that an enemy cannot take advantage of the cover afforded by the brush and trees in advancing on the position. Sometimes it is impracticable to secure sufficient ground for the encampment of the troops without clearing. For cutting away brush the best tools are heavy knives, machetes, billhooks, and brush hooks.

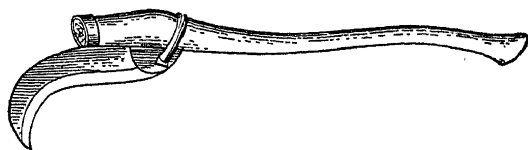


FIG. 4. BRUSH HOOK.

The removal of saplings and trees is usually done with hatchets, axes, and saws where sufficient time and tools are available. Where the urgency is greater, trees may be felled by the use of charges of gun cotton or other explosive material in holes bored in the trees or in the ground placed against the outside. The amount of clearing that can be done by a man in an hour varies considerably but may be placed usually at from 10 to 25 square yards.

**Military Surveys, Topographical Reconnoissances, and Maps.** Where a regular survey of a tract of land is desired for some military purpose, such as the construction of a fortification, or a map of a military reservation, the survey will be made in the same manner and under the same limitations as to time expended, accuracy required, and instruments used, as a similar survey for any civil purpose. With the steady extension of the mapping of the world's surface, more accurate maps suitable for use in military operations are becoming available. (See SURVEYING.) Where, however, a special survey is desired for use in connection with the movements of troops or with the planning of a battle, it is almost invariably found to be necessary to resort to hastier methods. These must depend upon the nature of the information desired and the time allowed. Much assistance can frequently be derived from

existing maps of the territory to be traversed. These generally fall short of giving all the information desired, and when they are available must usually be supplemented by topographical reconnoissances. The latter can be made either on foot or on horseback. Some progress has also been effected in late years in reconnoissance by air craft. In general, the information to be obtained is plotted as it is noted, with a view to having the map as nearly finished as may be when the route to be mapped has been traversed. The essentials for such a survey are paper for the map, an instrument for measuring distances, and an instrument for determining elevations and slopes. For many years such maps were, in the first place, plotted directly in notebooks or on pieces of paper ruled in one direction and attached to a light drawing board of such size that it could be readily carried by the reconnoitrer. The bearings of roads and objects were taken by a prismatic compass, or by a pocket compass, and were plotted on the map with the aid of a small protractor. Distances are usually measured by counting the number of steps or strides. Where a wheel of any kind accompanies the reconnoitrer, distances can be determined with reasonable accuracy by noting the number of rotations of the wheel by an odometer or other means. Differences in elevation of points are determined either by a hand level or by computation from the slopes which are measured with a hand clinometer. Many little devices assist greatly in the rapid completion and easy understanding of such a map. For example, if at the end of the day's work a red pencil be run over the roads, a blue one over the rivers and other water surfaces, and a green over the forests, much will have been done to add to the clearness of the map.

It was by these means that many of the topographical reconnoissances of the Civil War were made. The principal inconveniences of the method related to the size of the drawing board and to the fact that provision must be made for carrying the various auxiliary instruments in convenient places about the person. In recent years attempt has been made to develop a sketching case which shall combine all the essential tools for a topographical reconnoissance. One type is shown in the accompanying cut. It has been made possible in this case to use a much

in one side of the board permits the board to be oriented, i.e., placed in a position parallel to the one which it occupied in starting the survey. Holes are provided at one end of the board for holding pencils. A rough clinometer has been added at the other end. The type of sketching case now most generally used is similar to the above, but considered somewhat stronger and better adapted to rough usage. The scale of maps made in the field is almost always in inches and usually between 1 inch to the mile and 6 inches to the mile. As a rule, road sketches are now made on a scale of 3 inches to a mile, and position and outpost sketches, 6 inches to a mile. The 1-inch map is used for extended operations and 12-inch in siege operations. The scale used should be clearly shown on the map. A north-and-south line, the name of the reconnoitrer, and a clear title should also be plainly indicated.

Where the primary object of the survey is to obtain a road map, the road is gone over by the reconnoitrer and mapped directly on the paper. He indicates the position of the most prominent objects within range of the road, noting the names of places. Collateral information as to distances, water supply, camping grounds, food, fuel, etc., may also be given. Under other conditions, positions favorable for offense and defense are noted. The character of the roads so far as these may affect the movement of troops is recorded. Information relative to location and depths of intersecting watercourses, mountain passes, forests, railroads, tunnels, and bridges, is added. After practice an officer of ordinary aptitude can survey and map in this way nearly as much road as he can traverse at the assumed gait. Thirty miles have been mapped in a single day with sufficient accuracy for the desired purposes.

In case something more than a road map is desired, as, e.g., a map of a possible battlefield, more topographic detail should be shown. Everything which may have bearing in the case of a battle should be indicated. For example, in addition to all roads suitable for the movement of troops, there should be shown the depth of cuts, position of stone walls, woods, buildings, marshy ground, relative distances of level of hills and hollows, etc. The symbols used to represent topographical and hydrographical figures are designed to be rapidly made and readily understood and to resemble or suggest the actual figures they represent. In the United States a system of conventional signs for the use of all map-making departments of the government has been recently adopted by the United States Geographic Board. The use of numbers for symbols, somewhat along the lines of the decimal system of library classification, has also been considered. Any good engineer or surveyor can learn in a few days so to adapt his methods as to be able to prepare a fair military map. With additional practice his skill and judgment as to what should be added and what omitted in view of the limitations, as to size of map and time for making it, improve greatly. The usual method of indicating distances of level by means of contours, which are lines passing through all points of equal height, is the best for the purpose and should be used where practicable. The vertical interval varies, but for road sketches 20 feet is common and for position and outpost sketches, 10 feet. These maps contain inaccuracies which in an extended survey

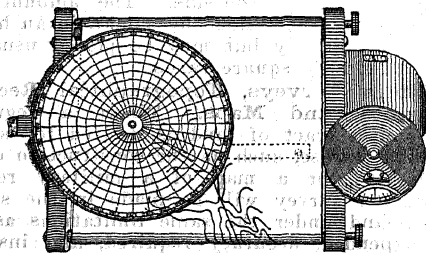


FIG. 516. A MODERN MILITARY SKETCHING CASE.

smaller drawing board because the paper can be rolled back and forth over it by means of the rollers on two opposite sides. The protractor can likewise be moved from side to side in a transverse direction. These two motions permit any point of the paper to be brought under the centre of the protractor. The protractor can be revolved freely around its centre, permitting a line to be drawn in any direction through any point on the paper. The compass

may, if not properly compensated, accumulate and become troublesome. Various means are resorted to for coordinating and correlating the maps of adjacent territory made by different officers. During the Civil War the general maps of the Peninsula were compiled almost entirely from reconnoissances on horseback. The railroad was accurately surveyed and served as a basis, while the wagon roads were mapped by different parties whose trails frequently crossed each other. In this way it was practicable so to adjust the errors as to obtain a general map of considerable accuracy. In General Sherman's march to the sea the topographical parties, which were kept a day in advance of the army, were enabled to furnish maps for the guidance of the commanding general and his subordinates throughout the entire march. Considerable progress has been recently made in the methods. Definite systems have been developed under which a number of men map adjacent parallel and connecting crossroads simultaneously, probable errors are compensated and reduced to a minimum, and the combined result made available promptly upon the completion of the fieldwork. Similarly a section of country is systematically and almost automatically subdivided, the different subdivisions simultaneously surveyed, and the results of all field assistants promptly combined. See Plate of TOPOGRAPHICAL MAP in article MAP.

In order that a map may be of the greatest service, it is desirable that a number of copies of it should be prepared and placed in the hands of the commanding general and his subordinates at the earliest moment after the completion of the survey. Several methods are in use for this purpose. One of the simplest is to trace the map on tracing linen; from this, if daylight be available, a number of prints can be made by the ordinary blue-print process. This work can be expedited by making from the tracing several brown " " " " which can in turn be used " " " " there be sufficient apparatus for making prints. If daylight be not available, prints may similarly be made by artificial light on bromide paper. Map duplication has also been effected with the aid of photography. A negative of the original map, usually on a smaller scale, is made with a camera. This negative is then used for printing positives by any of the usual photographic processes. For further detailed information on this subject, consult: articles in *Report on Proceedings of International Congress of Engineers, Division of Military Engineering* (Chicago, 1893); War Department, *Conventional Signs United States Army Maps* (Washington, 1912); *Professional Papers of the Corps of Engineers, United States Army; Engineer Field Manual* (United States War Department); Call and Stuart, *Individual and Combined Military Sketching* (Leavenworth, 1907).

**ENGINEERING INSTRUMENTS.** See SURVEYING INSTRUMENTS.

**ENGINEERING SCHOOLS.** See TECHNICAL EDUCATION.

**ENGINEERS, CORPS OF.** The Corps of Engineers of the United States army, organized in 1802, originally consisted of one colonel, one lieutenant colonel, two majors, four captains, four first and second lieutenants, and cadets; the whole number not to exceed 20. They were stationed at West Point, N. Y., and formed the nucleus of the present military academy. In

1838 the corps was increased to 47 officers, and a corps of topographical engineers organized and added to it. Sappers, miners, and pontoniers were added in 1846. At the commencement of the Civil War in 1861 three additional companies were provided for, and also one of topographical engineers, which in 1863 was disbanded, and its officers posted to the Corps of Engineers.

In 1866 the battalion of engineers was formed from the companies already organized. In 1901 the authorized establishment was increased to three battalions of four companies each, the company consisting of 164 enlisted men, rank and file, with two additional staff noncommissioned officers to each battalion. The band (28 men) is also included in the total authorized strength of the corps, which, excluding officers, is 2002 men. Most of these troops are now stationed at Washington Barracks, D. C. In 1914 there were companies or detachments at Vera Cruz, Mexico, Vancouver Barracks, Wash., Fort Shafter, Hawaii, Corregidor, Philippine Islands, and West Point, N. Y. During the war with Spain the engineer force was supplemented by three regiments of volunteer engineers.

The *United States Engineer School*, for many years at Willets Point, had charge of the instruction of officers of the corps, as well as of other arms of the service, in torpedo defense and of the former in engineering. Upon the reorganization of the United States army in 1901 the torpedo defenses were turned over to the artillery corps, together with the post at Willets Point, Fort Totten (q.v.); and the school and garrison were transferred to Washington, D. C. The course of instruction at the school is divided into three departments, (a) military engineering, (b) civil engineering, (c) electrical and mechanical engineering. Practical work and practice are combined with theoretical, in all subjects in which it can be advantageously done, and includes the use of instruments, apparatus, and machines.

An *Army Field Engineer School* has also been established at Fort Leavenworth, Kans., in connection with the Army School of the Line. A part only of the engineer officers are sent there. The object of the school is their preparation and that of engineer officers of the organized militia for the better performance of their military duties.

As may be seen from the following statement of its duties, the Engineer Corps is a scientific branch of the military service, and for this reason cadets graduating highest at West Point are usually assigned engineer commissions. The duties comprise reconnoitering and surveying for military purposes, including the laying out of camps; selection of sites and formation of plans and estimates for military defenses; the construction and repair of fortifications and their accessories; the installation of electric-power plants, cables and supplies pertaining to seacoast batteries; planning and superintending of defensive or offensive operations of troops in the field; the construction of fieldworks and fortifications; the creation and demolition of obstacles; the overcoming of such engineering obstacles as the terrain may disclose or the campaign present; examination of routes of communication for supplies and for military movements; construction and repair of military roads and bridges; the construction, operation, and maintenance of military railways when extensive

military operations of a field force are dependent on lines of railway for its supply in advance of the base; the execution of river and harbor improvements; and such other duties as the President or Congress may order. Under this authority the chief engineer and a majority of the members of the Isthmian Canal Commission were selected from the corps of engineers for the construction of the Panama Canal. The field service regulations provide that there shall be attached to each division of an army a pioneer battalion and an engineer field train, including all vehicles, animals, and *personnel* for transporting heavy intrenching tools, explosives, sand bags, and other engineer equipment and material. They also contemplate that there shall in addition be attached to each field army a pontoon battalion and train. The rank and file of the United States Engineer Corps are not required to be trained artificers before enlistment, instruction being given afterward. They are combatants and receive military as well as technical training. They are divided into non-commissioned officers, privates of the first class, and privates of the second class. During the Civil War many of the engineer officers attained high rank as general officers. Among the more notable names are those of Meade, McClellan, Humphreys, Wright, McPherson, and Warren in the Union army, and Lee, Johnston, and Beauregard in the Confederate army. See UNITED STATES, *Army*.

**European Engineer Corps.** The *Corps of Royal Engineers* of the English army was organized in 1763 and has always had its headquarters and training school at Chatham, near the south coast. Its strength in 1913 was 1051 officers, and 8742 noncommissioned officers and enlisted men. The latter are recruited from men who have served an apprenticeship to some trade, preferably machinists, electricians, carpenters, masons, bricklayers, smiths, painters, printers, telegraphists, etc. The corps has always been on a different basis from the other branches (excepting artillery) of the army, even in the days of the purchase system, which never applied to the engineers. First appointment as a commissioned officer is obtained through the Royal Military Academy at Woolwich by open competitive examination. Students are examined and classed and receive commissions in the engineers and artillery according to their standing. Those selected for the engineers are sent to Chatham for two or more years before receiving their active commission. Officers and men receive extra pay in addition to their regular daily pay. The peace establishment comprises 5 field troops, 15 field companies, 3 bridging trains, 15 telegraph companies, 1 balloon school, 1 searchlight company, 3 railway companies, 29 fortress companies, 2 coast companies, 3 survey companies, 10 fortress depot companies, 1 feed depot, and 1 colonial survey section. The corps is stationed throughout the British Empire. The pioneer sergeants of all infantry regiments, artificers by trade, must also be in possession of a Chatham certificate. Officers and noncommissioned officers of cavalry and infantry may also obtain certificates as assistant instructors of field works, if nominated to attend the short course of instruction at Chatham set apart for them.

The *French Engineer Corps* consists of 20 battalions, which are formed into regiments in time of peace for purposes of instruction. In

time of war the company becomes the unit. The ordinary company assigned to a division comprises 310 officers and enlisted men. In addition pontoon companies and park companies are assigned to corps and army headquarters. Three of the battalions are made up of special railway companies. European military critics generally give the corps a high rating for efficiency.

The *German Pioneer troops* (*Technische Truppen*) number 29 battalions. The normal battalion has 25 officers and 600 enlisted men in time of peace. In time of war the number of enlisted men is increased from 150 to 270 per company. In time of peace an experimental company is organized in each battalion for testing out new apparatus and consists of 5 officers and 114 men, 95 of whom are detailed from the battalions. There is also a special body of railroad troops, including 183 officers and 4496 men, organized both for building and operating purposes. At the outbreak of war each battalion mobilizes a supply battalion which remains at the home depot to receive and forward men, equipment, implements, and supplies.

The *Russian Engineer Corps* comprises 119 sapper companies, 19 pontoon companies, 77 railway companies, 16 balloon companies, and 46 telegraph companies. The organization of the Russian army calls for the assignment of an engineer battalion to each army corps. The engineer services of *Austria, Italy, Rumania, Holland, Belgium, and Spain* are generally similar in organization to the French and German. As a rule, the European engineers perform the duties assigned in the United States to both the engineer and the signal troops. See ARMY ORGANIZATION; ENGINEERING, MILITARY.

**ENGIS, ən'zhē'.** An archaeological station on the banks of the Meuse, near Liège, Belgium, noted for the discovery of human remains in deposits belonging to the Quaternary period. See MAN, ANCIENT TYPES.

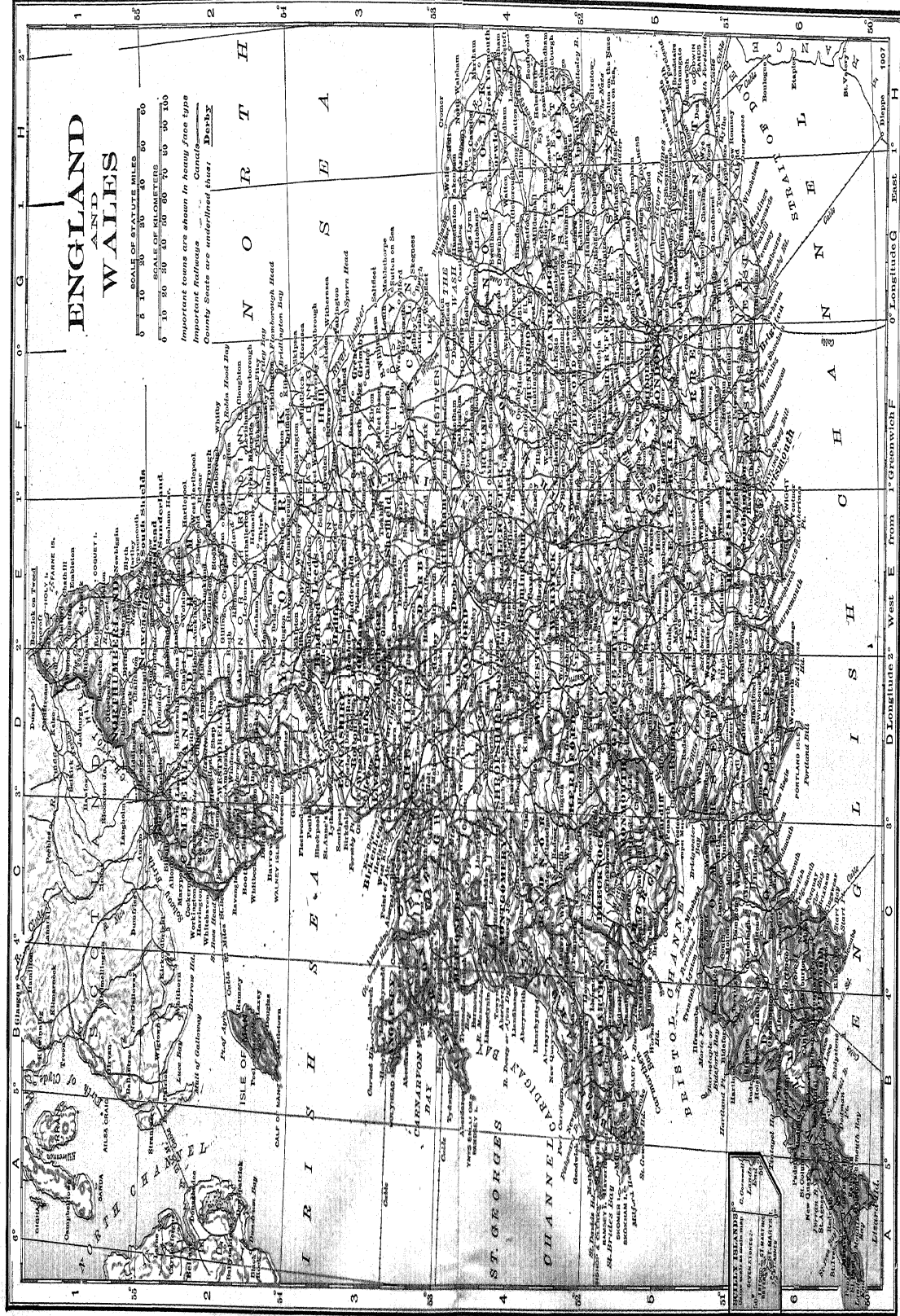
**ENGLAND, ɪn'glənd.** The most important member of the United Kingdom of Great Britain and Ireland (Map: Europe, C 3). The name England is commonly applied to the entire southern portion of the island of Great Britain, but it will be limited here to the ancient historical division, reserving Wales for treatment under a special head. A general discussion of the physical and climatic features, flora, fauna, etc., of England, as well as of Scotland and Wales, will be found under the title GREAT BRITAIN.

The southernmost point of England is in lat. 49° 57' N., and its northern extremity in lat. 55° 46'. England is roughly triangular in shape and comprises an area, according to official determinations, of 50,851 square miles. The south side of the triangle has a length of 315 miles, while the east and west coasts, about 350 miles and 400 miles long respectively, exclusive of windings, converge northward, the boundary with Scotland being at Solway Firth, the Cheviot Hills, and the river Tweed. The coast is so broken by headlands, bays, and inlets that England alone has a coast line nearly 2000 miles in length, and the localities farthest inland are not more than 75 miles from the sea. All important manufacturing centres are within 50 miles of a seaport. The commercial situation is further improved by numerous navigable rivers, which penetrate deeply into the interior.





Important towns are shown in heavy face type  
Important Railways      Canals      Derby  
County Seats are underlined thus:





The greater number of rivers flow to the east, the more important of these being the Thames, Humber, and Tyne. They are longer than the western rivers, which include the Severn and the Wye, are less liable to floods, and are more useful for navigation. Topographically England differs from Scotland and Wales in that a large part of its area is low land. With the exception of the peninsula of Cornwall and Devon, the Lake District, and the Pennine Chain, the country is a coastal plain, broken by minor escarpments and gentle downs, but nowhere exhibiting true mountainous forms, sloping down gradually to the southeast; none of the elevations present formidable obstacles to communication. The geological structure of England is characterized by a variety such as is usually found only in countries of much greater area. In the western highlands the basal formations comprise Archæan gneisses and granites and early Paleozoic sediments, while eastward there is a succession of strata in ascending order up to the Quaternary. The Carboniferous rocks are limited to small areas, but they include numerous coal seams of almost unparalleled thickness. Nearly all of the formations yield minerals of economic value, ranging from gold, silver, and tin to the more common metals and non-metallic products.

**Mining.** England has great resources of coal, and annually produces about 70 per cent of the coal output of the United Kingdom. There are two principal producing areas—the region about Newcastle and that of southeastern Lancashire, southwestern Yorkshire, northern Derbyshire, and western . . . . . The production of the former . . . . . was: Durham, 41,719,000 tons; Northumberland, 14,683,000; and of the latter district, Yorkshire, 39,137,000; Lancashire, 23,675,000; Derbyshire, 17,171,000; Nottinghamshire, 11,623,000 tons. Other producing regions in 1911 yielded amounts as follows: Staffordshire, 14,050,000 tons; Monmouthshire, 13,799,000, and other districts, 14,388,000 tons; total, 190,244,000 tons, as compared with 271,892,000 for the United Kingdom. Wales produced 39,845,000 tons. There is usually a slight annual increase in production, and increasing amounts are annually shipped to foreign countries. England is the greatest coal-exporting nation, because its mines are nearer to seaports than those of any other great producing country, and the largest coal buyers are the neighboring countries of Europe. The total coal production of England and Wales in 1911 was 272,000,000 tons, valued at approximately \$550,000,000. The exports of coal and coke in 1911 amounted to 67,000,000 tons valued at nearly \$200,000,000.

England produces scarcely any of the precious metals, and of the others, iron is the only one that is produced in large quantities. The annual output of iron is exceeded only by the United States and Germany, though the home demand is so great that the local production supplies but about two-thirds of the quantity used in home industries, while the stated value of that imported exceeds the stated value of the home product. A great advantage of the iron industry is that the coal needed to fuse the ore and the limestone required for fluxing are found near the ore. Yorkshire supplies the greater portion, but north Derbyshire and Cumberland supply the valuable red hematite ores, while the black iron ore of Sweden and the hematite

of Spain are largely imported. Tin ore is mined in Devon and Cornwall, the largest European sources of the metal. Copper ore is now nearly exhausted. In Northumberland lead and zinc are mined together.

**Fisheries.** The greater part of the large annual fish catch of the British Isles is accredited to the English and Welsh coasts, and fish is the only article of food that is yielded in adequate supply. The total value of the product (English and Welsh coasts) increased from £3,683,063 in 1887 to £6,816,375 in 1902 and £9,210,881 in 1912. Great Yarmouth, Grimsby, and Hull are the centres of the industry; but the greater part of the catch goes to Billingsgate, London, which is the largest fish market in the world. The herring catch was valued at £1,665,000 in 1912; cod, £1,448,000; haddock, £1,350,000; plaice, £1,051,000; hake, £598,000; soles, £464,000. A great many fish are brought alive in tanks on the fishing vessels to the ports, whence they are sent on fast trains to the great centres of consumption.

**Agriculture.** England differs from other countries outside of the United Kingdom in the remarkable extent to which her lands are concentrated in the hands of a small percentage of the population and in the universality of the capitalistic system of tenure. It is estimated that all estates exceeding 125 acres in area, amounting to four-fifths of the total cultivated area, are held by 38,000 landlords. The greater part of the agricultural land is rented. In 1911 the acreage under crops and grass occupied by owners was 2,970,632 in England, 276,339 in Wales, and 569,881 in Scotland, while the total cultivated area in Great Britain was 32,094,658. The number of farm holdings was 374,653 in England and 60,657 in Wales; those from 1 to 5 acres numbered 82,538 in England and 10,210 in Wales; 5 to 50 acres, 167,628 and 32,112; 50 to 300 acres, 110,110 and 17,965; over 300 acres, 14,377 and 370; total, 374,653 and 60,657. Average size of holdings, 65.3 acres in England and 45.7 in Wales. Of the total number of holdings in England, 326,529 (or about 87 per cent) were rented; in Wales, 54,605 (90 per cent). As compared with the United States, the system of cultivation is more intensive, requiring a much greater outlay of capital, which is furnished by capitalist farmers, and hence the method is known as the capitalistic system. More is expended upon each of the items—rent, labor, fertilizers, and machinery—than in the United States, estimated upon an acreage basis. England, more than any other European country, has followed the example of America in the adoption of labor-saving machinery, and this has been partly responsible for the diminution in the number of agricultural laborers. The other factor which tends to lessen the number of agricultural laborers is the recent decrease in the raising of crops. The increasing competition of the United States and other foreign countries that are favored with cheap land and cheap transportation, and that do not yet find it necessary to buy so large an amount of expensive fertilizers, has been disastrous to the interests of the English farmer. The cost of transporting grain from other parts of the world has been greatly reduced, the freight rate on wheat from New York to Liverpool having averaged about 3 cents per bushel from 1900 to 1910 against 21 cents in 1873, 9 cents in 1883, and 5 cents in 1893. The principal crops are

wheat, barley, oats, beans, turnips, potatoes, hay, and fruits. The numerous large towns afford a market for a large gardening industry.

Stock raising is very important. The towns are so numerous that milk is the chief dairy product, no other country depending so largely upon imports of butter. The north and west, or the elevated and more humid portions of England, are largely given over to grazing, while in the eastern portion the growing of cereals and other crops is more common, though stock raising is also prominent throughout this region. The three coast counties—Lincolnshire, Yorkshire, and Essex—lead in the production of wheat, the average yield in these counties sometimes approaching the remarkable figure of 40 bushels per acre. No country surpasses England in the superior quality of her domestic animals, and no other has contributed so many varieties of the standard breeds. The name of the county or region in which the breed originated is generally used to designate them, such as the Devonshire, Lancashire, or Durham cattle, Southdown sheep, and Berkshire hogs. There are 10 or 12 native breeds of cattle, the most important being the Shorthorn, which, originating in the Tees district of Durham over a century ago, has spread all over the country and is widely distributed abroad. Hereford and Sussex cattle are famous for beef, and Shorthorn and Devon for both beef and milk.

**Manufactures.** England is famed in manufacturing industries as numerous as the farmers; the percentage thus employed is larger than in any other country. The extensive resources of coal and iron have been the most prominent of the numerous influences which have fostered the development of manufacturing. The textile industry leads in importance, there being, in 1907, 1,087,223 persons employed in the textile factories of England and Wales, of whom 679,863 were females. The proximity of coal fields, commercial advantages, and an atmosphere laden with an unusual amount of moisture, important in spinning, have all favored the centralization of the industry in limited regions in the north of England. Cotton manufacturing, which has long been the chief branch of the textile industry, is centred in the Manchester district, the city of Manchester itself being the commercial centre of the industry. The surrounding towns, however, including Oldham (which possesses one-third of all the cotton spindles in England), Bolton, Blackburn, Preston, Rochdale, Burnley, and Stockport, do most of the spinning, and two of them, Preston and Burnley, most of the weaving.

The woollen industry is centred in the portion of Yorkshire adjacent to the Manchester district, i.e., the West Riding of Yorkshire. Leeds and Bradford are the two most important woollen-manufacturing towns—the one being noted for its broadcloth, the other for alpaca, mohair, and woollen damasks. Huddersfield, Halifax, and Wakefield are also worthy of note for their production of woollens. A number of woollen factories are also located in Gloucestershire. England does not compare with Ireland in the production of linens, though the industry is of some importance in the towns of Leeds and Barnsley. Silk manufacture is of decreasing importance, but is still carried on in Coventry, Macclesfield, and other towns south of the cotton and woollen manufacturing regions.

The localization of metal manufactures and

manufactures of machinery, etc., which rank next in magnitude to the textile industry, is determined largely by the resources of coal and iron, and hence these are the most developed in the northern part of England. Birmingham, the southernmost of the large centres of this industry, is noted for the production of all kinds of metal work, and particularly gun barrels. Sheffield is another town in which manufacturing of iron and steel is the chief industry, steel cutlery being its specialty. Leeds and Manchester produce enormous quantities of machinery, while Newcastle-upon-Tyne and Sunderland lead English towns in shipbuilding. England is a large producer of beer, Burton-upon-Trent leading in its manufacture. The manufacture of pottery and earthenwares is an important industry in north Staffordshire, along the headwaters of the Trent, where china clays abound. A number of places, including the Tyne district and the south of Lancashire, have large manufactures of chemicals.

**Transportation.** England is exceptionally well provided with transportation facilities. The extensive coast line and navigable waterways afford excellent natural advantages, and these have been supplemented by a remarkable artificial system. Through the canalization of streams, and the construction of a network of canals, almost every part of the country is accommodated with this method of transportation. The importance of the canals has, however, greatly declined, as most of them are too shallow and narrow for the present demands of traffic. The highways are kept in an almost perfect condition. The bulk of the transportation, however, is done by railways. The railway mileage in England and Wales in 1902 was 15,501, and, in 1912, 16,223. The railways now also have control of a considerable part of the canal system. London is the focal point of the principal lines, which include the Great Western, the London and Northwestern, the Midland, the Great Northern, the Great Eastern, and the Southwestern, all under private ownership and management.

**Commerce.** In various ways England has been greatly favored as a commercial centre and as a carrier of the world's commerce. London is the greatest trade centre in the world and has the largest shipping tonnage, while Cardiff (Wales) and Liverpool are exceeded in shipping tonnage outside of England only by New York, Hamburg, Antwerp, Rotterdam, and Chicago. The shipping of Cardiff is mainly confined to its heavy export of coal; the trade of Liverpool is largely with America and West Africa, consisting of heavy imports of grain, cattle, and other food products and cotton, and exports of manufactured goods and machinery. The trade of London is more widely distributed, but is particularly large with European and Oriental countries, its imports being considerably in excess of its exports. See *Commerce*, under GREAT BRITAIN.

**Population.** England, with 669 inhabitants to the square mile, is the most densely populated country in the world. The population increased from 11,281,883 in 1821, to 27,483,490 in 1891, to 30,813,043 in 1901, and 34,045,290 in 1911, in the latter year constituting 75.3 per cent of the population of the United Kingdom, as against 74.3 per cent in 1901, 56.1 in 1841, and 54 per cent in 1821. The percentage of increase in the decade ending with 1901 was 12.1,

as against 20.7 for the United States in the decade ending with 1900. From 1901 to 1911 the increase was 10.5 per cent, as compared with 21 per cent in the United States from 1900 to 1910. In common with most of the civilized world, England shows a steady decline in birth rate and death rate. In England and Wales the birth rate decreased from 29.3 per thousand in 1898 to 26.5 in 1907 and 23.8 in 1912; the death rate for these years was 17.5, 15.1, and 13.3. The increase per cent by births, in England and Wales, in the ten-year period 1891-1901 was 31.57; decrease by deaths, 19.18; natural increase, 12.39; in the ten-year period 1901-11, increase by births, 28.56; decrease by deaths, 16.13; natural increase, 12.43. The actual increase per cent in these two periods was 12.17 and 10.89, the difference between natural increase and actual increase being accounted for by excess of emigrants over immigrants.

In 1911 the number of males in England was 16,421,298 and of females 17,623,992 (or 1073 females to 1000 males); in Wales, 1,024,310 males and 1,000,892 females (or 977 females to 1000 males).

England is characterized by its large city population, a larger percentage being urban than in any other country. In England and Wales the population of urban districts in 1901 numbered 25,058,355, and of rural districts 7,469,488; in 1911, 28,162,936 and 7,907,556. In 1851 the percentage of population in urban districts in England and Wales was approximately 50.2; in 1861, 54.6; in 1871, 61.8; in 1881, the actual percentage was 67.9; in 1891, 72.0; in 1901, 77.0; and in 1911, 78.1. The report on the 1911 census points out that the increase in the proportion of the population resident in urban districts, although mainly due to an actual growth of the population within those areas as existing in the earlier census years, is also partly to be accounted for by the extension of those areas themselves, owing to the absorption of areas which were previously rural. Thus, while the 1901 population of urban districts was 25,058,355, the 1901 population of urban districts as constituted in 1911 was 25,351,118 (the 1901 population of rural districts as constituted in 1911 being 7,176,725). The general increase per cent in England and Wales was 10.9 in the period 1901-11; the urban increase was 11.1 and the rural 10.2. In the preceding intercensal period the rates of increase in the urban and rural districts (as constituted in 1901) were 15.2 and 2.9 respectively. Thus, while the rate of increase in urban districts has declined, that in rural districts has risen; it should be pointed out, however, that the rates in the last decennium represent an actual increase of 2,811,818 persons in the urban and of only 730,831 persons in the rural districts.

Below are named the urban districts which in 1911 had upwards of 5000 inhabitants each; the table shows their area in acres, their population in 1901 and in 1911, and the percentage of increase during the decade. In the case of Birmingham, Burnley, Reading, and Sheffield, the boundaries were extended subsequent to the census, and the figures given are for the new areas; but the figures for the areas existing at the time of the census are shown in the line immediately following (C.B., county borough; M.B., municipal borough; U.D., urban district, specifically so called).

TABLE OF URBAN DISTRICTS SHOWING AREA, POPULATION, ETC., FOR DECADE ENDING 1911.

URBAN DISTRICTS	Population			
	Area Acres	1901	1911	Inc. %
London (Adm. Co.)	74,816	4,536,267	4,521,685	-0.3
Birmingham C.B.	43,601	759,063	840,202	10.7
Birmingham†	13,478	523,179	525,833	0.5
Liverpool† C.B.	16,042	704,134	746,421	6.0
Manchester† C.B.	21,045	644,873	714,333	10.8
Sheffield C.B.	24,353	410,893	459,916	11.9
Sheffield†	23,662	409,070	454,632	11.1
Leeds† C.B.	21,593	428,968	445,550	3.9
Bristol† C.B.	17,460	339,042	357,048	5.3
West Ham (outer ring) C.B.	4,683	267,358	259,030	8.1
Bradford†	22,881	279,767	288,458	3.1
Kingston-upon-Hull† C.B.	9,042	240,259	277,991	15.7
Newcastle-upon-Tyne† C.B.	8,452	247,023	266,603	7.9
Nottingham† C.B.	10,935	239,743	259,904	8.4
Stoke-on-Trent C.B.	11,142	214,712	234,534	9.2
Salford C.B.	5,202	220,957	231,357	4.7
Portsmouth C.B.	6,100	188,928	231,141	22.3
Leicester C.B.	6,532	211,579	227,222	7.4
Cardiff (Wales) C.B.	8,373	164,333	182,259	10.9
Bolton C.B.	15,279	168,215	180,851	7.5
Croydon (outer ring) C.B.	9,012	133,895	169,551	26.6
Willesden (outer ring) U.D.	4,384	114,811	154,214	34.3
Rhondda (Wales) U.D.	23,885	113,735	152,781	34.3
Sunderland C.B.	3,357	146,677	151,159	3.5
Oldham C.B.	4,736	137,246	147,483	7.5
Tottenham (outer ring) U.D.	3,014	102,703	137,418	33.8
East Ham (outer ring) M.B.	3,324	96,008	133,487	39.0
Blackburn C.B.	7,418	129,216	133,052	3.0
Brighton C.B.	2,536	123,478	131,237	6.3
Birkenhead C.B.	3,848	110,915	130,794	17.9
Leyton (outer ring) U.D.	2,594	98,912	124,735	26.1
Walthamstow (outer ring) U.D.	4,343	95,181	124,580	31.0
Derby C.B.	5,272	114,848	123,410	7.5
Norwich† C.B.	7,896	113,922	121,478	6.6
Southampton C.B.	4,604	104,824	119,012	13.5
Preston C.B.	3,971	112,980	117,088	3.6
Gateshead C.B.	3,132	109,888	116,917	6.4
Swansea (Wales) C.B.	5,202	94,537	114,663	21.3
Plymouth C.B.	2,374	107,636	112,030	4.1
Stockport C.B.	5,488	92,832	108,682	17.1
South Shields C.B.	2,399	100,858	108,647	7.7
Huddersfield C.B.	11,859	95,047	107,821	13.4
Burnley C.B.	4,819	97,350	106,765	9.7
Burnley C.B.	4,005	97,043	106,322	9.6
Coventry† C.B.	4,147	69,978	106,349	52.0
Middlesbrough C.B.	2,685	91,302	104,767	14.7
Halifax C.B.	13,983	104,944	101,553	-3.2
St. Helens C.B.	7,284	84,410	96,551	14.4
Wolverhampton C.B.	3,525	94,187	95,328	1.2
Walsall C.B.	7,483	86,430	92,115	6.6
Rochdale C.B.	6,446	83,114	91,428	10.0
Northampton C.B.	3,469	87,021	90,064	3.5
Wigan C.B.	5,083	82,428	89,152	8.2
Reading C.B.	9,106	80,823	87,693	8.5
Reading C.B.	2,876	72,217	75,198	4.1
Hornsey (outer ring) M.B.		72,056	84,592	17.4
Newport (Monmouth) C.B.	4,504	67,270	83,691	24.4
York† C.B.	3,730	77,914	82,282	5.6
Devonport C.B.	3,152	70,437	81,678	16.0
King's Norton and Northfield* U.D.	22,456	57,122	81,153	42.1
Merthyr Tydfil (Wales) C.B.	17,761	69,228	80,990	17.0

\* Part was annexed to Birmingham in November, 1911.  
† City of.

The following table shows the area of the English counties (administrative counties and county boroughs), with population according to



the censuses of April 1, 1901, and April 3, 1911, and the percentage of increase:

COUNTIES	Area Sq. mi.	Population		Inc. %
		1901	1911	
Bedfordshire	473.3	171,707	194,588	13.3
Berkshire	724.7	259,069	280,794	8.4
Buckinghamshire	749.0	197,046	219,551	11.4
Cambridgeshire:				
Cambridge	492.4	120,264	128,322	6.7
Isle of Ely	372.0	64,495	69,752	8.2
Cheshire*	1,025.6	835,941	954,779	14.2
Cornwall	1,356.5	322,334	328,098	1.8
Cumberland	1,520.9	266,933	265,746	-0.4
Derbyshire	1,016.2	599,694	683,423	14.0
Devonshire	2,611.5	622,196	699,703	5.7
Dorsetshire	977.5	202,063	223,266	10.5
Durham	1,014.4	1,187,474	1,369,860	15.4
Essex	1,530.5	1,083,998	1,350,881	24.6
Gloucestershire†	1,259.0	708,439	736,097	3.9
Hampshire:				
Southampton	1,498.3	714,164	862,393	20.3
Isle of Wight	147.1	82,418	88,186	7.0
Hertfordshire	841.9	114,125	114,269	0.1
Hertfordshire	632.0	258,423	311,284	20.5
Huntingdonshire	365.6	54,125	55,577	2.7
Kent	1,524.9	961,139	1,045,591	8.8
Lancashire	1,867.1	4,378,293	4,767,832	8.9
Leicestershire	831.8	437,490	476,553	8.9
Lincolnshire	420.3	77,610	82,849	6.8
Parts of Kesteven	27.9	103,962	111,324	7.1
Parts of Lindsey	1,516.3	318,450	369,787	16.1
London	116.9	4,536,267	4,521,685	-0.3
Middlesex	232.0	792,476	1,126,465	42.1
Monmouthshire	546.2	298,076	395,719	32.8
Norfolk‡	2,054.8	476,553	499,116	4.7
Northamptonshire				
Northampton	914.3	294,506	303,797	3.2
Soke of Peterborough	83.5	41,122	44,718	8.7
Northumberland	2,018.0	603,119	696,893	15.5
Nottinghamshire	843.9	514,459	604,098	17.4
Oxfordshire	748.8	179,962	189,484	6.9
Rutlandshire	152.0	19,709	20,346	3.2
Shropshire	1,346.6	239,783	246,307	2.7
Somersetshire	1,621.3	434,950	458,025	5.3
Staffordshire	1,158.3	1,183,998	1,279,649	8.1
Suffolk:				
East Suffolk	870.9	255,800	277,155	8.3
West Suffolk	610.8	117,553	116,905	-0.6
Surrey	721.6	653,661	845,578	29.4
Sussex:				
Sussex	829.0	450,979	487,070	8.0
West Sussex	627.9	151,276	176,308	16.5
Warwickshire	945.7	1,083,069	1,247,418	15.2
Westmoreland	789.6	64,409	63,575	-1.3
Wiltshire	1,350.1	271,394	286,822	5.7
Worcestershire	716.2	363,490	387,688	6.7
Yorkshire:				
East Riding	1,172.2	385,007	432,759	12.4
North Riding	2,128.6	377,338	419,546	11.2
West Riding	2,771.1	2,761,321	3,045,377	10.3
York, City of§	5.8	77,914	82,282	5.6
England	50,874.0	30,813,043	34,045,290	10.5
Wales	7,465.9	1,714,800	2,025,202	18.1
England and Wales	58,340.0	32,527,843	36,070,492	10.3
Wales with Monmouthshire	8,012.1	2,012,876	2,420,921	20.3

\* The county borough of Stockport is deemed to be situated in the administrative counties of Chester and Lancashire, but the entire borough is here included in Cheshire.

† The county borough of Bristol is deemed to be situated in the administrative counties of Gloucester and Somerset, but the entire borough is here included in Gloucestershire.

‡ The county borough of Great Yarmouth is deemed to be situated in the administrative counties of Norfolk and East Suffolk, but the entire borough is here included in Norfolk.

§ The county borough of York is deemed to be situated in each of the three administrative counties of the East, North, and West Ridings of Yorkshire, but the entire borough is here shown separately.

¶ Cambridgeshire is not an administrative county, but its component parts, Cambridge and Isle of Ely, are administrative counties, likewise in the case of Hampshire (with respect to Southampton and Isle of Wight) Lincolnshire (Parts of Holland, Parts of Kesteven, and Parts of Lindsey), Northamptonshire (Northampton and Soke of Peterborough), Suffolk (East Suffolk and West Suffolk), Sussex (East Sussex and West Sussex), and Yorkshire (East Riding, North Riding, and West Riding).

At the 1911 census, among the 1137 urban districts of England and Wales, there were 97 (including the administrative county of London as one district) each of which had a population exceeding 50,000. These districts in 1891 had a population of 13,779,848; in 1901, 15,886,874 (the increase being 15.3 per cent); in 1911, 17,251,009 (increase 8.3 per cent). London (i.e., the administrative county, embracing 74,816 acres) had, in 1911, 4,521,685 inhabitants, as compared with 4,536,267 in 1901, the decrease being 0.3 per cent. The City of London (comprising 675 acres) decreased from 37,702 in 1891 to 26,923 in 1901 and 19,658 in 1911, the decrease per cent in the two intercensal periods being 28.6 and 27.0. "Greater London" is a term used to describe the combined Metropolitan and City of London police districts; it contains, besides the administrative county of London, a wide belt of suburban towns and districts, known as the "outer ring." This outer ring had, in 1891, 1,405,852 inhabitants; in 1901, 2,045,135; in 1911, 2,729,673; the increase per cent in the two intercensal periods being 45.5 and 33.5. The outer ring in 1911 embraced the following areas: in Surrey, 80,099 acres, with 526,366 inhabitants (increase over 1901, 36.8 per cent); in Kent, 43,281 acres, with 172,327 inhabitants (14.1); Middlesex (entire administrative county), 148,701 acres, with 1,126,465 inhabitants (42.1); in Hertfordshire, 36,091 acres, with 54,905 inhabitants (22.7); in Essex, 60,436 acres, with 849,610 inhabitants (26.4); total, 368,608 acres, or 576 square miles, with 2,729,673 inhabitants (33.5). Greater London (i.e., the administrative county plus the outer ring) embraced 443,424 acres, or 693 square miles, with 7,251,358 inhabitants. Greater London in 1861 had 3,222,720 inhabitants; in 1871, 3,885,641 (the increase being 20.6 per cent); in 1881, 4,766,661 (22.7); in 1891, 5,633,806 (18.2); in 1901, 6,581,402 (16.8); the percentage of increase from 1901 to 1911 was 10.2. The percentage of increase from 1861 to 1911 was 125.0, that of the administrative county being 61.0 and that of the outer ring 559.0.

**Education.** The extension of educational facilities in England, with adequate opportunities for elementary instruction for all, is a recent development. From the first the question of religion has been one of the most influential factors in determining the history of the educational movement. For a long time the efforts of the state in behalf of education were confined almost wholly to grants in aid of denominational or private schools. In districts where ample school accommodations are not provided school boards are elected by the people, women who are independent ratepayers being entitled to vote. By the cumulative system of voting, minority religious sects are able to secure representation on the board. School-attendance committees are appointed in districts where there are no school boards. There is a compulsory act for the attendance of children of 11 years of age and under, and from 12 to 14 there is compulsory attendance, but with provision for conditional exemption. Parliamentary aid is given to poor districts in which the local rates are not adequate. Aid is also given to voluntary (denominational or private) schools in districts not provided with board schools, the grant being upon the basis of average attendance. In the administrative counties, excluding London and the county boroughs, the attendance

at the voluntary schools much exceeds that of the board schools; but in London and the county boroughs the reverse is true. Tuition, since 1891, has been practically free. At the end of the school year 1912, 6,037,370 pupils were enrolled in the public elementary schools of England and Wales; average attendance, 88.79 per cent. Nonsectarian religious instruction is given at the board schools; but such instruction must be either at the beginning or end of the school session, and any child may be withdrawn by his parents from such instruction. At the voluntary schools sectarian instruction may be given. In 1900 the control of elementary education was vested in a Board of Education, this body taking the place of the Education Department and the Department of Science and Art. Illiteracy is rapidly decreasing, as is shown by the decreasing number of persons who sign the marriage registers by mark, these amounting in 1903 to 1.9 per cent of the males and 2.3 per cent of the females.

Secondary education is not well organized. Heavy grants have been made for technical education, but the term "technical instruction" was interpreted to include all secondary education except the dead languages, and thus secondary instruction profited from the grants rather than the purely technical branches. The evening continuation schools mostly cover the field of secondary instruction and have attained a remarkable growth. In 1912, 784,984 pupils were in average attendance at the 8561 evening and similar schools. Much is being done also, both in the field of secondary and of higher education, by university extension work. The question of means and methods for providing better secondary educational facilities is one of the primary points of consideration in the educational controversy which has become so acute in England.

At the beginning of the nineteenth century Oxford and Cambridge were the only English universities. During that century four others were added, of which London University, established in 1836, has a larger faculty and attendance than any other English university. Durham University was established in 1831, Victoria University of Manchester in 1880, Birmingham University in 1900, Liverpool University in 1903, Leeds University in 1904, Sheffield University in 1905, and Bristol University in 1909.

**Religion.** England has an established state church, commonly called the Church of England. However, there are numerous dissenting churches, and in attendance and membership throughout the country the state church is supposed to lead by a slight majority only. The faith of the church, since the Reformation, is known as Protestant Episcopal; but while the name includes the whole organization, as a matter of fact the church membership is divided into factions whose positions are widely divergent on matters of belief. In recent years the High Church, or Ritualistic faction, which is reactionary in its tendencies, approximating the Roman Catholic church in its extremes, has been most active and aggressive, and has become the dominating element in the church. The Broad Church, representing an opposite or liberal tendency in belief and ritualism, though much smaller in its following, has also increased at the expense of the original Low Church. Another feature that is in a way connected with the recent religious movement within the

state church is the increased rate of growth of the Roman Catholic church, as it is a part of the general tendency to revert to a more definite dogma and a more elaborate ritualism. It is true, however, that the Catholic church has for a long time gained, and still gains, much from immigration, particularly that from Ireland. The number of Roman Catholics in England and Wales was estimated as over 1,800,000 in 1913. There are no governmental religious statistics from which may be made comparative studies of the different denominations; but the figures here used (the estimates include Wales) are taken from reasonably reliable estimates. From these it is found that among dissenting bodies the Methodists are strongly in the lead, the Wesleyan branch, with 516,596 (1910) communicants, far exceeding in numbers any other form of Methodism. The Congregationalists and the Baptists, with 454,810 and 418,680 communicants respectively, are next in numerical strength, while the Presbyterians, who are so predominant in Scotland, number only 86,608. The Salvation Army has a considerable following, and there is a large number of small denominations, including Bible Christians, Friends, Unitarians, etc. Special emphasis is placed upon Sunday-school work, the number of scholars claimed by most of the denominations being more than twice the number of their communicants. Jews are estimated at 196,000.

**Ethnology.** The racial history of England covers many thousands of years. Chipped stone implements of the Chellean type have been found in the Thames valley, associated with bones of elephants, also at Hoxne in Suffolk, in the valley of the Ouse, in the Isle of Wight, in the valley of the Avon, and in the caves of Brixham, Ken's Hole (Devonshire), of Robin Hood (Derbyshire), and in Wookey Hole (Somersetshire). The middle, or Mousterian, epoch is not fully represented, and fewer still of Magdalenian implements have been found. In 1913 a very old type of skeleton was found in Sussex associated with Chellean implements, indicating that the British Isles have been inhabited from the earliest times. (See MAN, ANCIENT TYPES. Consult Duckworth, *Prehistoric Man*, Cambridge, 1912, for summary of explorations.) The earliest neolithic race known was long-headed (dolichocephalic), so much so that Boyd Dawkins was disposed to identify them with the Eskimo. Then followed the man of the Long Barrows, who buried his dead in stone chambers covered with oval mounds. He was low in stature and also long-headed, and some of his descendants are still to be seen in Devonshire and elsewhere. The Round Barrow man, who followed with the use of pottery and metals and burning his dead, was, on the contrary, above the average in height, strong-jawed, and broad-headed (brachycephalic). Who was this brachycephalic man? Opinion is divided. Doubt has been expressed as to his Celtic origin, and he has even been assigned to the northern Mongolian or Turanian race. At any rate, a primitive dark people of Celtic speech was later overlaid by a lighter one. The dawn of written history witnessed the invasions of Teutonic long-heads and the retiring of the Round Barrow man. The Romans in their conquests changed the biological character of the English but little. Saxon, Dane, Norwegian, and Norman, all long-heads, century after century, pushed the broad-heads into Wales, North Scotland, and Ireland.

The largest proportion of the people of England are now dolichocephalic (index, 76-79). This uniformity in head form proceeds from two ethnic types—the Mediterranean or Iberian in Spain and the Teutonic in Scandinavia. Consult: Keane, *Man: Past and Present* (Cambridge, 1899); Ripley, *Races of Europe* (New York, 1899); Macnamara, *Origin and Character of the British People* (London, 1900); Keith, *Ancient Types of Man* (ib., 1911). In the supplement to the last-named work, under the head "British Isles," will be found an exhaustive list of the many valuable works on the ethnology of England.

## HISTORY

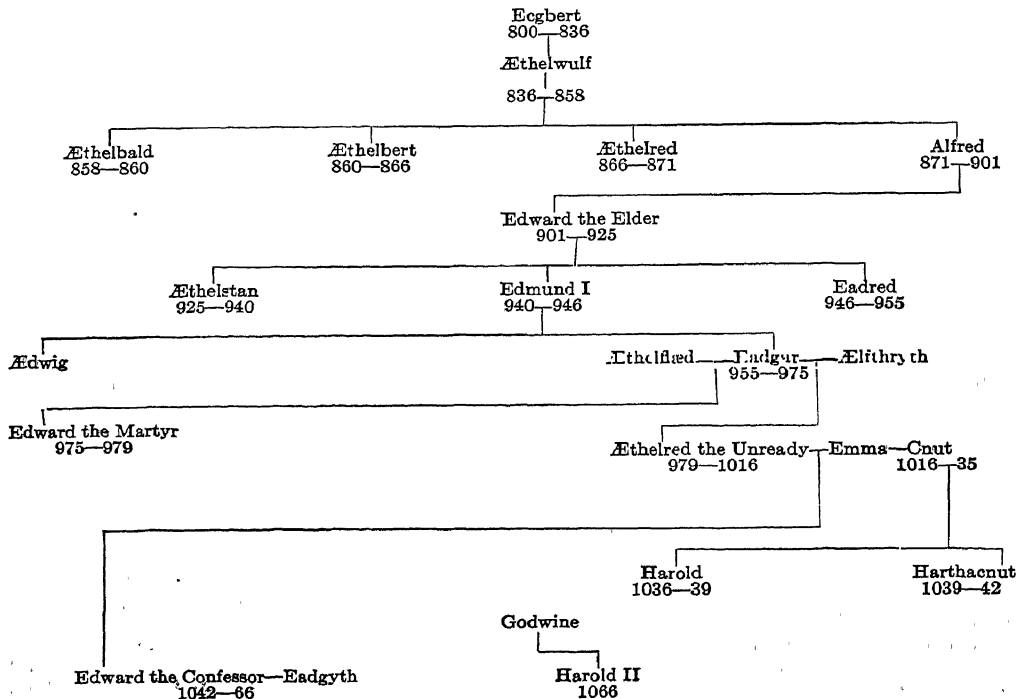
Of the inhabitants of England before the first century B.C. little is known. In some of the ancient geographers there are a few scattered notices of a rude population, with whom a limited commerce in tin was carried on by the Phœnician merchants; but further than this our information scarcely extends. (See *BRITANNICÆ INSULÆ*.) With the two invasions of Julius Cæsar, in 55 and 54 B.C., the recorded history of England may be said to begin. It was not until a century later, however, that the Romans made a serious attempt to conquer the island. Between 43 and 84 A.D. they subdued all that portion of the island south of the Firth of Forth, and after that they held possession for over 300 years. The Christian religion was introduced, and the people became Roman to a very great extent. During the period of migrations the Romans were compelled, early in the fifth century, to recall the legions from Britain. (See *BRITANNIA*.) Consult, for the Roman occupation of Britain, Haverfield, *The Romanization of Roman Britain*, 2d ed. (Oxford, 1912); for

both the Pre-Roman period and Cæsar's invasions of the island, see Holmes, *Ancient Britain and the Invasions of Julius Cæsar* (Oxford, 1907). An account of the country during the period intervening between the withdrawal of the Romans and the Norman Conquest will be found under *ANGLO-SAXONS*.

During the latter half of the reign of Edward the Confessor (1042-66) the government was actually directed by Harold, son of Earl Godwin; and on the death of Edward, Harold, although not of the royal line, was chosen King by the nobles and bishops. William, Duke of Normandy, claimed that this election was illegal and that the crown belonged rightfully to him. He based his claim (1) on his wife's claim through descent from Alfred and on his own kinship to Edward; (2) on an alleged promise of the crown made by Edward; (3) on an oath of support which Harold was said to have given. With the blessing of the Pope and at the head of an army of adventurers, William invaded England in 1066. On October 14 the two rivals engaged in battle at Senlac, near Hastings, and the army of Harold was overthrown and he himself slain. The greater part of the nation was soon weary of the strife, and on Christmas Day, 1066, William received the crown through election by the Witan. During the next five years the conquest was completed, and William was universally recognized. He remodeled the church, replacing the English clergy with Normans and asserting his own supremacy. He checked the power of the nobility by the Salisbury Oath, in 1086, when every free man swore fealty directly to the King; by the abolition of the great earldoms which had existed under Edward; by bestowing many small and scattered fiefs, instead of large contiguous tracts of lands on his

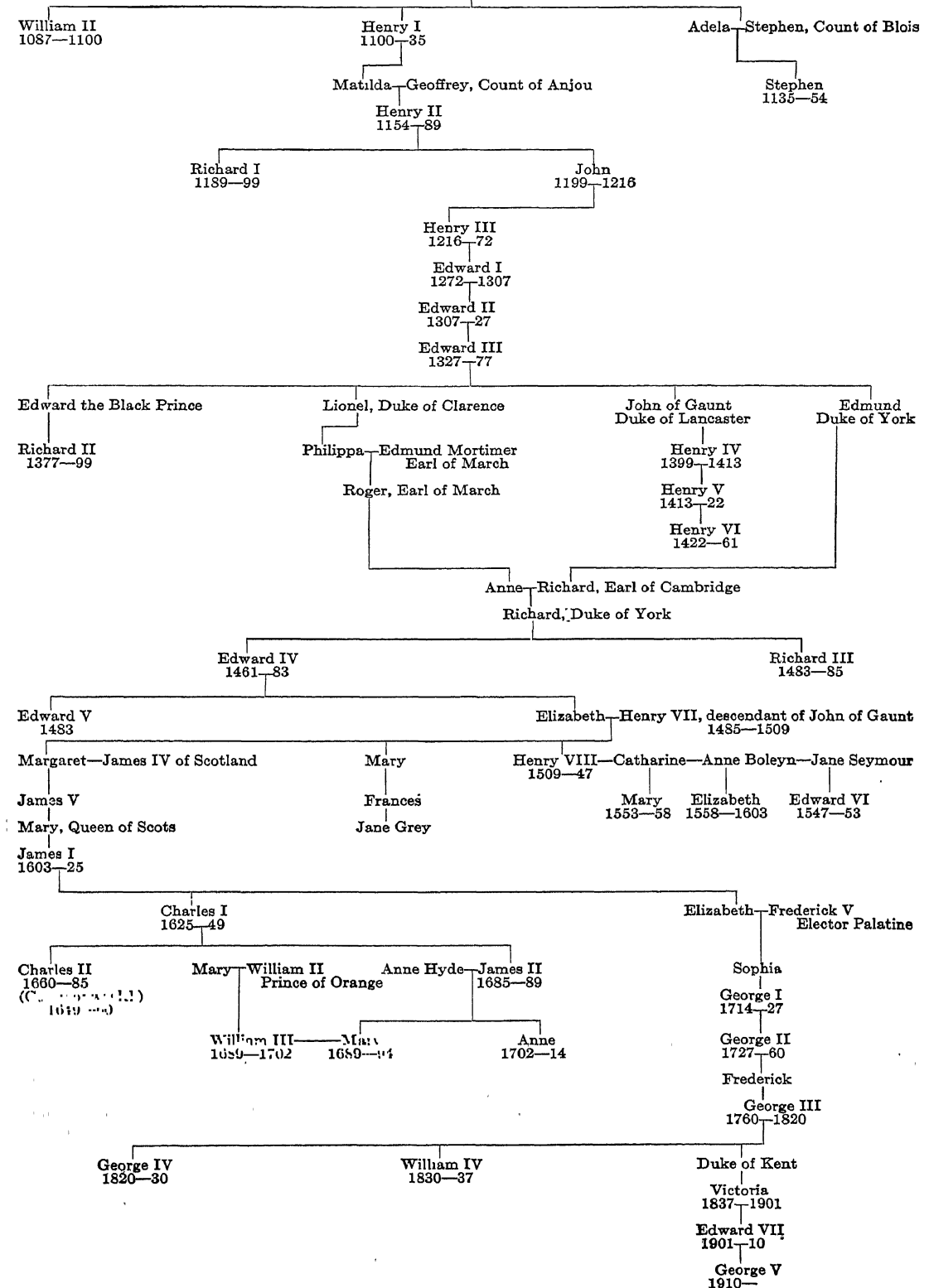
## GENEALOGICAL TABLE

## ENGLISH KINGS AND QUEENS



## WILLIAM THE CONQUEROR

1066-1087



chief tenants; and by maintaining the old local moots, which were independent of the baronial courts. He conciliated the people by his strict justice and by confirmation of the laws of Edward the Confessor. William caused a survey to be made of all the lands in England, the results of which were embodied in the Domesday Book, completed in 1086. His son, William Rufus (1087-1100), ruled tyrannically, and provoked revolts both among the chief barons and the clergy. After his death Henry I (1100-35), his brother, usurped the throne and won general support. He granted the Charter of Liberties (1100), by which the evil customs of the preceding reign were abolished. He married an English wife and showed especial favor to his English subjects, who in return supported him against his brother Robert, Duke of Normandy. He made peace with the church by recalling the Archbishop of Canterbury, who had been exiled by his brother, and by arranging a compromise concerning the subject of investitures (q.v.) on practically the same lines as the Concordat of Worms. (See CONCORDAT.) Unfortunately Henry's son and heir was drowned in the White Ship, in 1120, and this led to a civil war, for Henry persuaded the Great Council to swear allegiance to his daughter Matilda; but after his death his nephew, Stephen of Blois, seized the crown and won the support of London and some other sections. The war between the adherents of Stephen and Matilda dragged on from 1136 to 1153. During this time the nobles became all-powerful, building many "adulterine" (i.e., unauthorized) castles, and the clergy became independent of royal control. In 1138 King David of Scotland, who was supporting Matilda, was defeated in the Battle of the Standard. From 1139 Matilda herself waged war in England. Stephen was generally unsuccessful, and in 1153 he was obliged to conclude the Peace of Wallingford, by which Henry, son of Matilda and of Geoffrey Plantagenet, Count of Anjou, was accepted as Stephen's successor.

With the accession of Henry II (1154-89), the first Plantagenet King, England entered upon a new phase of its history. His possessions in France were far more extensive than in England. From his father he inherited Anjou, Maine, and Touraine; from his mother, Normandy and a claim to the overlordship of Brittany. By his marriage with Eleanor, the divorced wife of Louis VII of France, he had secured Aquitaine. For a time there was danger that England would become merely a province dependent upon the French lands of Henry. There was also a great possibility that Henry might wrest from the French King, whose territories were insignificant in extent by the side of Henry's, the overlordship of all France. Henry spent most of his reign on the Continent, ruling his territories; yet he found time to reestablish the royal authority in England. He maintained order, secured greater power for the royal judges, who made yearly circuits, gave authority to grand juries to examine into criminal cases, enrolled all the freeholders, and compelled them to bear arms in his service by the Assize of Arms. In attempting to reform the church and restrict its authority, by the Constitutions of Clarendon (1164), he came into conflict with Thomas à Becket. (See BECKET, THOMAS À; CLARENDON, CONSTITUTIONS OF.) The murder of Becket compelled Henry to abandon for a time a part of his claims to control the church: but, on the whole,

he was able to assert his authority effectively later in his reign. He also became Overlord of Scotland and Wales, whose rulers submitted to him. In 1171 he invaded Ireland and was recognized as ruler by most of the Irish kings. The real conquest of Ireland (q.v.), however, did not take place for some centuries. Henry's autocratic administration made many rebels. Chief among these were his own sons, who successively rose in insurrection and were aided by the French kings. Two of his sons—Henry, the heir to the throne, and Geoffrey—died during their father's lifetime. Finally, the coalition of Philip Augustus of France and Richard the Lion-Hearted, Henry's third son, who were joined soon after by John Lackland, the King's youngest son, defeated Henry, in 1189. His death followed almost immediately. Richard (1189-99) spent less than a year in all in England. The first half of his reign was spent on his Crusade; the second in an indecisive war with France. At his accession a great massacre of Jews took place at York, greatly to Richard's anger. The excessive taxation necessitated by Richard's foreign expeditions aroused great discontent. His brother John (1199-1216) was extremely tyrannical and cruel. His evil rule caused a general revolt, which resulted to the great advantage of the whole nation. Philip Augustus stripped him, in 1202-03, of a great part of his French possessions, under a decree of confiscation, because John refused to go to the court of his overlord, Philip, to answer crimes charged against him and to do homage for his fiefs. A dispute about the election of an archbishop of Canterbury caused a quarrel between Pope Innocent III and John, who refused to receive Stephen Langton (q.v.), the nominee of the Pope. In 1208 Innocent placed England under an interdict, and the following year excommunicated John. The latter attempted resistance, but when he feared to be deposed by the Pope in 1213, and realized that he could expect no aid from his disaffected subjects, he submitted and became the vassal of the Pope, accepting England as a papal fief and agreeing to pay 1000 marks each year in recognition of his vassalage. He had felt obliged to surrender to Innocent because he was threatened with a revolt of his own subjects, and hoped to break their resistance by the Pope's aid. When, however, his attempt to reconquer his French territories was defeated by the victory of Philip Augustus over Otho IV of Germany, the ally of John, at Bouvines (1214), his subjects determined to revolt. The barons met in January, 1215, and demanded the redress of their grievances. As John procrastinated, they marched in arms against him and compelled him, in June, to sign the Magna Charta. This contained no new principles, but was a written acknowledgment of the rights of the vassals. From it were gradually deduced two great English principles—that no one should suffer arbitrary imprisonment, and that no tax should be imposed without the consent of the council of the nation. The charter was frequently confirmed and its terms took on a broader meaning until it became the "palladium of English liberties." Twenty-five barons were constituted a committee to see that the provisions of the charter were observed. John, however, had no intention of keeping his agreement, and the Pope annulled the charter and excommunicated the leaders in the revolt. The barons then offered the crown

to Louis, son of Philip Augustus, who landed in England. Before a decisive combat took place John died, Oct. 19, 1216. See MAGNA CHARTA.

His son, Henry III (1216-72), who was a mere boy, was crowned, and the English barons rallied to his support. Louis was driven from the kingdom, through the efforts of the Justiciar Hubert de Burgh (q.v.), and England was saved for the English. For 11 years the country was well governed by William Marshall and Hubert de Burgh. Then ensued a period of misgovernment under Henry's personal rule. He confirmed the charter repeatedly, but never kept his promises. He favored foreign nobles, allowed English livings to be given to Italians, and was wholly subservient to the Pope. In 1258 the barons, exasperated by his conduct, met in the so-called "Mad Parliament." They were led by Simon de Montfort, the King's brother-in-law. They demanded a better government and the observance of the charter. By the Provisions of Oxford (q.v.), which they enacted, the government was transferred from the King to a council of barons. Their rule was not successful, however, and in 1264 Louis IX of France, who had been asked to be the arbitrator between the King and the barons, gave his opinion in the so-called *Mise of Amiens* that the provisions were illegal. Civil war ensued. Henry was defeated at Lewes (1264), and by the *Mise of Lewes* the King was compelled to agree to the demands of the barons. The following year Simon de Montfort, who was the real ruler, called a Parliament, to which burghers were summoned, as well as the barons, clergy, and knights of the shire. This precedent was followed later by Edward I. In the same year Simon was killed in the battle of Evesham, in which the baronial forces were overthrown by the King's troops, under the command of Prince Edward. Simon's son and some of the barons continued the struggle for about a year longer, but all parties were weary of the strife and longed for peace. Under the "Ban of Kenilworth" they all surrendered, and in 1267 Henry, by the "Statutes of Marlborough," granted almost all their demands. Peace followed, and Edward I (1272-1307) inherited a united kingdom. He ruled justly, in accordance with the charter and with the aid of Parliament. In 1298, by the *Confirmatio Cartarum*, he agreed that no tax should ever be levied except by common consent. From this time the government was to be managed conjointly by the sovereign and Parliament. The latter Edward had strengthened by summoning, in 1295, the "Model Parliament" which was composed of the tenants in chief, representatives of all classes of the clergy, knights of the shires, and two citizens from each city or borough. By his other laws Edward attempted to restrict the power of the clergy and of the barons. The most noted were the "Statute of Winchester" (1285), which renewed the "Assize of Arms"; the *Quia Emptores* (1290), which restricted subinfeudation; and the "Statute of Mortmain" (1279), which forbade the acquisition of land in "mortmain" by the church. Edward is frequently called "the English Justinian." He subdued Wales between 1277 and 1283, and Edward II, born in Carnarvon Castle (1284), received the title of Prince of Wales, which has been borne by the heir apparent ever since. In 1290 the Jews were expelled from England. Edward claimed the overlordship of Scotland as a preliminary to his acting as arbitrator between the various

claimants to the throne, and received the homage of Baliol, to whom the crown was awarded, in 1292. The Scotch, however, rose in resistance under great leaders like Wallace and Bruce, and Edward's incompetent son and successor, Edward II (1307-27), proved unequal to the task of retaining his father's conquests. After various wars (see SCOTLAND), the principal event of which was the battle of Bannockburn (1314), by the Treaty of Northampton, in 1328, the independence of Scotland was acknowledged. Edward II was a weak ruler, who spent his reign in a continuous struggle with the barons. The general result was a weakening of the royal authority. His wife, Isabella, and her lover, Mortimer, headed a rebellion against him, and were joined by Prince Edward. The unfortunate King was deposed by Parliament in 1327, and was soon afterward murdered. Edward III (1327-77) attempted unsuccessfully to regain authority over Scotland, which was aided in the contest by France. The attitude of France was one of the causes which led to the Hundred Years' War (q.v.). In addition, Edward feared that he might lose Gascony, the most important French possession which England had, and that Flanders, the great wool market for England, might be seized by the French King. He therefore laid claim to the French crown, as the grandson of Philip IV. As his descent was through the female line (see SALIC LAW), his claim was not held by the French to be legally good; but it was sufficient as a cause for war. The first period of the war was distinguished by the great English victories of Crécy (1346) and Poitiers (1356), and ended with the Peace of Bretigny (1360). By this treaty Aquitaine was ceded to England, and Edward abandoned his claim to the French crown. His wars compelled him to seek aid constantly from Parliament, and to grant to it more extensive powers. In the midst of the war England was visited, in 1348 and 1349, by the terrible scourge of the Black Death, which is said to have destroyed more than one-third of the population. Labor became scarce, and the "Statute of Labourers" was enacted, for the benefit of the landlords, in 1349, to prevent the peasants from demanding higher wages and to compel them to perform their services as villeins. This caused great discontent, which was fomented by the preaching of the Lollards (q.v.), the followers of John Wiclif. Edward III was succeeded in 1377 by Richard II. The collection of a poll tax in 1381 led to the Peasants' Revolt, in which Wat Tyler was one of the leaders. The revolt was suppressed with great cruelty by the nobles. Richard II was under the control of the great barons, except for brief periods of personal rule through favorites, until 1389. The barons were determined to wrest all authority from the King, and in the "Wonderful" or "Merciless Parliament" (1388) impeached the King's advisers. But the following year Richard secured full authority, and ruled in accordance with the Constitution until 1397. In the meantime the Hundred Years' War had been dragging on, having been renewed in 1369, and the French had reconquered Aquitaine. Richard was bent upon a French alliance, not a war, and in 1396 married Isabella, the eight-year-old daughter of King Charles VI of France. This marriage, and his surrender of Brest and Cherbourg to the French, incensed his subjects. The surrender was just, as these cities had been pledged



to him as security for a debt, and the debt had been paid; but his subjects did not understand this, and thought that he was sacrificing English interests. Moreover, his revenge, in 1397, on the leading members of the baronial party, for which he had been biding his time, raised up many enemies. While Richard was absent in Ireland, in 1399, Henry Bolingbroke, Earl of Hereford, the son of John of Gaunt (Duke of Lancaster, fourth son of Edward III), landed in England and was joined by many of the leading nobles. Richard was compelled to abdicate in 1399, and Hereford was chosen King by the Parliament as Henry IV. Thus Parliament asserted the right to regulate the succession, and the house of Lancaster obtained the crown. Before leaving the reigns of Edward III and Richard II, it is necessary to notice their long series of laws directed against the pretensions of the papal curia. By the "Statutes of Provisors" (1351 and 1390), the Pope was prevented from disposing of English livings. By the "Statutes of Præmunire" (1353 and 1393), the powers of the curia were greatly restricted, and Englishmen were subjected to severe penalties if they appealed to the curia or obtained bulls from Rome. The "Statute of Mortmain" was also reënacted, in substance, in 1392.

The reign of Henry IV (1399-1413) was marked by a strict adherence to constitutional forms, by frequent rebellions, and by the persecution of the Lollards. As he owed his title wholly to Parliament, Henry felt obliged to pay to it due deference; and, as he had received aid as a champion of the church, he thought it necessary to persecute heresy. The statute *De Heretico Comburendo* was passed against the Lollards in 1401, and in the ensuing years some were burned. The rebellions were caused by the adherents of Richard. The most noted was the conspiracy of the Earl of Northumberland, his son, Harry Percy, surnamed "Hotspur," and Owen Glendower. This was crushed in the great battle of Shrewsbury (1403). The reigns of Henry V (1413-22) and Henry VI (1422-61) were notable mainly for the continuation of the Hundred Years' War. Henry V had renewed the claim to the French crown. The claim was popular in England, as the war was looked upon as a national one. The brilliant victory of Agincourt (1415) flattered the national pride. In 1420, by the Treaty of Troyes, Henry was declared heir to the French throne. His early death, leaving only an infant son, Henry VI, frustrated all the hopes of the English, although the royal infant was crowned King of France, and the English held most of the French kingdom. The marvelous career of Joan of Arc (q.v.) and a general national rising in France caused the loss of all the French possessions except Calais in 1453. The mental incapacity of Henry VI and the ill success of the French war caused the house of York to put forward a claim to the throne, which resulted in the Wars of the Roses. (See ROSES, WARS OF THE.) It is impossible to enter into the details of these wars, in which there were frequently apparent reconciliations and alternate victories. Edward, Duke of York, was proclaimed King, as Edward IV, in 1461, and reigned until 1483, although Henry VI was restored for a time in 1470-71, through the efforts of the Earl of Warwick, the great kingmaker. Edward V, son of Edward IV, became King on the death of his father, but the throne was almost immediately usurped by

Richard III, brother of Edward IV. In 1485 Richard met his death on Bosworth Field, when Henry Tudor, Earl of Richmond, invaded England. The long war had thus caused two changes of dynasty—from Lancaster to York, and then again to Lancaster or Tudor. Almost all of the old nobility were destroyed while fighting on one side or the other. The crown obtained great wealth through confiscation of the property of its opponents, and was thus rendered independent of parliamentary grants. Consequently, Parliaments were seldom summoned. There was much illegal taxation, in the form of enforced "benevolences," or gifts from the subjects. This period paved the way for the despotism of the Tudors.

With the union of the houses of Lancaster and York by marriage under Henry VII (1485-1509), the modern period for England begins to dawn. The great nobles having exterminated themselves in the Wars of the Roses, during which wars the House of Commons had become the mere tool of opposing factions, there was room for that increased strength of royal power which marks the beginning of the modern epoch. By enforcing the law of livery and maintenance, Henry VII kept the nobles, while his court of Star Chamber gave justice to the weak against the strong, in cases which the ordinary courts could not reach. He levied illegal taxes, called "benevolences," from the richer classes without consent of Parliament. Henry's hold on the throne was for twelve years. Frequent and serious disturbances by Yorkist pretenders marred a reign generally characterized by peace and economy and marked the beginning of an extensive commercial development. In 1497 John Cabot sailed from Bristol and secured for England the credit of the discovery (or rediscovery) of the mainland of North America. It was during Henry VII's reign that the Renaissance began to prevail in England, which had not developed there as early as on the Continent, owing to the unsettled conditions resulting from the constant civic strife of the previous reigns. Henry VIII's reign ushered in the Reformation.

The origin of the Reformation in England was the divorce which Henry VIII (1509-47) desired to have from his wife, Catharine of Aragon. Failing to secure this from Pope Clement VII, he had the English clergy and some of the European universities declare the marriage void, and married Anne Boleyn. He found in his able minister, Thomas Cromwell, in Thomas Cranmer, Archbishop of Canterbury, and in a subservient Parliament, which sat from 1529 to 1536, the willing agents of his schemes. Parliament passed a series of acts completely separating the Church of England from Rome, rendering the inferior clergy amenable to the civil courts, and placing the laws, as well as the actions, of the clerical convocation under the King's control. Chief of these acts was the Act of Supremacy, in 1535, appointing the King "Protector and only Supreme Head" of the Church of England. In 1536, the smaller monasteries were suppressed and a translation of the Bible was authorized; in 1538 relics and images were destroyed and in 1538-40 the greater monasteries were suppressed. Nevertheless the Six Articles of 1539 enforced conformity with the chief doctrines of the Catholic church. Henry VIII's ecclesiastical policy was intimately connected with his numerous marriages, and resulted in changes far beyond what he or his advisers contemplated. His own

motives were mainly selfish and sensual. He squandered his father's enormous hoard, plundered the church, debased coinage, and left the kingdom poor. The confiscated church property he bestowed on favorites, founding a new aristocracy and gentry, who were later the mainstay of the Tudor dynasty. But these were harder masters than the conservative monasteries, and inclosed the common pasture and arable lands into sheepwalks, turning out the peasantry, and otherwise disregarding their time-honored customs. This made the Reformation unpopular with the masses.

Under Henry's successor, Edward VI (1547-53), a minor, the reformation of doctrine followed. The First Book of Common Prayer (1549) established a uniform service in the English language. The Second Book of Common Prayer (1552) was a more marked advance towards Protestantism, and the Forty-two Articles (1553) were even Calvinistic in tone. But these were without consulting the people; ministers and courtiers using the Reformation only for private gains, and made it still more unpopular. Two rebellions occurred—Jack Kett's rebellion against the inclosure of the common lands in Norfolk, and another in Cornwall and Devon against the Reformation itself. Under Mary (1553-58), a devout Catholic, the reaction came. The Parliament of 1553 restored Catholic worship, but was unwilling to return confiscated church property and to tolerate the subordination of England to Spain by Mary's proposed marriage to Philip. An attempted rebellion under Sir Thomas Wyatt and the Duke of Suffolk was suppressed, and the Queen married Philip of Spain. In 1555 Parliament repealed the laws of Henry VIII, thus reuniting the Church of England with Rome. In the persecution of the Protestants that followed, nearly 300 victims are said to have been burned, Bishops Ridley and Latimer and Archbishop Cranmer among them.

The policy of Elizabeth (1558-1603) was a compromise between the radical and reactionary tendencies of her predecessors. By the Act of Uniformity (1559) the use of a new prayer book, based on that of Edward VI, was established, and the Act of Supremacy (1559) made her the "supreme governor of the Church." The Thirty-nine Articles (1563), a revision of the Forty-two Articles, fixed the final constitution of the Anglican Church, with Protestant dogmas, but with a retention of the hierarchy, and in part of the cult, of the Catholics. But above all else the church was national. Archbishop Parker was the chief instrument in bringing about this desired result. The advice of her able minister, William Cecil, enabled Elizabeth to handle political questions with equal success. On the Continent she aided the Protestants in their struggles against the overwhelming power of Spain, especially in the Netherlands. The Invincible Armada, sent in 1588 to subdue England, was defeated by Howard and Drake, and Elizabeth became the acknowledged head of the Protestants of Europe. At home she was equally successful, ruling in harmony with her people, though not always agreeing with Parliament. The economic legislation of her reign was so well founded that it lasted nearly two centuries. Navigation laws built up a marine, corn laws aided agriculture, and the great trading companies, like the Muscovy, Eastland, Levant, and East India companies, exported English productions and brought

wealth to England. The Renaissance bore fruit in the most brilliant of English literary epochs. See ENGLISH LITERATURE.

On the death of Elizabeth the house of Tudor was succeeded by that of Stuart, the crowns of England and Scotland being united under James, the son of Mary, Queen of Scots. In striking contrast with the preceding reign, that of James I (1603-25) presents constant quarrels with the people at home and incapacity abroad. James believed in the "divine right" of kings, but not in absolute monarchy. A majority in Parliament sought not parliamentary supremacy but some division of power between King and Parliament. The King was conceited and lacking in tact and judgment; the Puritans in Parliament had advanced views regarding popular government. In the first dispute (1604) James declared that there were no privileges which Parliament could enjoy except by the favor of the King; while the House of Commons held that "They did not ask for anything that was not in accordance with justice, and they did not demand a single privilege that was not necessary for the good of the nation as well as for their own dignity." In the Great Protestation of 1621 Parliament asserted its right to debate on state affairs and advise the King concerning them. Although the authorized translation of the Bible was made in his reign (1604-11), he thwarted the general desire for greater liberty of Protestant practice in the church and favored the hierarchy. "No bishop, no king," was his motto. He forced an unpopular episcopacy on Scotland. His unwise attempt to obtain a Spanish marriage for his son brought on a useless and expensive war. The inglorious conduct of this war, and of another against France, waged by his favorite Buckingham, by draining the royal coffers, helped to bring on the Puritan revolution.

Unable to obtain supplies without redressing the grievances of Parliament, James's son, Charles I (1625-49), raised forced loans, imprisoning those who refused. In May, 1628, Parliament passed the Petition of Right, in which all forms of taxation without consent of Parliament were prohibited; there should be no martial law in time of peace, and no one should be imprisoned except on specific charges. Charles was obliged to assent, but on the remonstrance against his levying tunnage and poundage, prorogued Parliament. After the stormy session of the following year, he ruled for eleven years without Parliament, raising money by illegal and questionable methods. His chief ministers were Thomas Wentworth, an able but intolerant and uncompromising man, who reduced Ireland to order and obedience, and Archbishop Laud, who attempted to enforce church uniformity by the observance of a high ritual distasteful to the people. The King's instrument of judicial oppression was the Star Chamber (q.v.), composed of the Privy Council and two justices, while the ecclesiastical commission attended to the Puritans. An attempt to force a new ritualistic prayer book on Scotland caused the abolition of the episcopacy, liturgy, and canons there, and an armed invasion with which Charles was unable to cope. He was forced to call a Parliament and ask for supplies. When that body insisted first upon a redress of grievances he dissolved it after a session of only three weeks. But the Long Parliament was convened the same year (1640). Led by Pym and Hampden, it passed an act of attainder

against Wentworth, now Earl of Strafford, who was executed, and abolished both Star Chamber and ecclesiastical commission. Another act forbade the King to dissolve the existing Parliament without its own consent. In 1641 came the Grand Remonstrance (q.v.) and the impeachment of the bishops; and Charles's ill-advised attempt to seize the five leaders of the opposition and the struggle between King and Parliament to control the militia hastened the now inevitable war, which opened with the indecisive battle of Edgehill in 1642. The Scotch were drawn into the struggle, Parliament adopting their Solemn League and Covenant. Reorganized on the New Model (q.v.) by Cromwell, the Parliamentary army bore down all before it. At Marston Moor and Naseby the King was hopelessly beaten. In 1646 Charles became a prisoner of the Scotch, by whom he was handed over to Parliament; his execution took place on Jan. 30, 1649. But the army, which was independent in religion and desired toleration of the sects, came into conflict with the intolerant Parliament, which was Presbyterian. "Pride's Purge," Dec. 6, 1648, turned out 143 Presbyterian members. England was declared a commonwealth in 1649. The army under the lead of Cromwell crushed the rebellion in Ireland with great bloodshed, and beat the Scotch, who had risen for Charles II. The inevitable result was that the army ruled supreme. Oliver Cromwell, its general, was declared Lord Protector in 1653, and ruled with subservient parliaments till his death (1658). His policy was the French alliance against Spain, a war for commercial supremacy with the Dutch, and toleration for all except Catholics at home. Repeated rebellion, however, forced him to withdraw toleration from Episcopalians. On the death of Cromwell, in 1658, his son Richard was named Protector. He abdicated in the following year. In 1660 General Monk marched upon London and put an end to the Puritan régime.

With the Restoration came reaction against the austere morality of Puritan times. Charles II (1660-85) lived chiefly for pleasure. His advisers were in the main men of much the same type, most of them, like him, being in pay of Louis XIV of France. Two ruinous wars with Holland were waged in the interests of that power. Internal legislation was reactionary. Acts were passed compelling magistrates and municipal officers, clergymen, fellows of the universities, and schoolmasters to conform with the Established church, and ministers who refused were forbidden to come within five miles of an incorporated town or their former parishes. In 1673 the Test Act was passed, excluding Catholics and Nonconformists from public offices. A fictitious popish plot resulted in disgraceful persecutions of the Catholics on the testimony of Titus Oates (q.v.), a perjurer. Attempts to exclude from the throne the Duke of York, who had embraced Catholicism, failed through the King's opposition. By unscrupulous use of the courts, the charters of all boroughs were confiscated and remodeled in the King's interest. The Habeas Corpus Act, however, insuring a fair trial to every prisoner, was passed in 1679. The three years of James II's reign (1685-88) were taken up with an attempt to restore the Roman Catholic religion chiefly by illegal means. By his power of dispensing with the law, he set at naught the Test Act, and forced Catholics into

the universities, the army, and even into the royal council. He also gathered a standing army to further his designs. Failing to secure toleration for Catholics from the Established church, he tried to form an alliance with the Dissenters, but only with partial success. His illegal proclamation of indulgence was resisted by the bishops, whom he tried in vain to convict of libel. The birth of a male heir, with the prospect of a perpetuation of his tyranny, wore out the public patience. Seven of the most influential men of England invited William of Orange to invade the country. His mere appearance was enough to overthrow the government, and James fled to France.

**The Development of Cabinet Government.** William III was the husband of Mary, the eldest daughter of James II. The Convention Parliament of 1689, which was assembled to determine the succession, offered the crown to William and Mary conjointly, accompanying the offer with the Declaration of Right. This document, embodied in the famous Bill of Rights, put an end to the dispensing power as used by James, enacted that no Roman Catholic could wear the crown, and established the supremacy of statute law over the King's proclamations. The theory of the Restoration had been that the King and Parliament were coördinate in power and should act in harmony with each other; but this had been demonstrated to be impossible by the reign of James II. Henceforth the King's ministers were answerable to the House of Parliament, and cabinet government began. The ministers were now changed in accordance with the political complexion of the House of Commons. Although William III had frequent cause for provocation from the corrupt politicians of his day, he maintained a wise and moderate domestic policy. The Toleration Act gave Dissenters freedom of public worship. In 1694 triennial Parliaments were provided for, and the Bank of England was founded. William's foreign policy involved England in two long wars against France under Louis XIV, for the second of which he had just prepared when an accident terminated his life (1702). His successor, Queen Anne (1702-14), was a good-hearted woman, of no ability. During the first part of her reign she was under the influence of the Duke of Marlborough. On the Continent he continued William's policy, leading the allied English, Dutch, and German forces to brilliant victories over the generals of Louis XIV, especially at Blenheim and at Malplaquet, which forced Louis to sue for peace. In 1707, before the end of this war, the legislative union with Scotland was accomplished. Forty-five Scottish members were added to the Commons and sixteen to the Lords, but Scotland retained her own law, church, and fortresses. For the history of the United Kingdom, see GREAT BRITAIN and the authorities there referred to.

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**ENGLAND, BANK OF.** See BANK, BANKING.

**ENGLAND, CHURCH OF.** The dominant religious body in England, for the greater part of her history the established church of the country. It is necessary to bear in mind the prior existence of a *British* church which, like the British nation, was subsequently either uprooted, subdued, or assimilated in part—a fact which has an important bearing upon the claims which are made as to its antiquity and continuity. The exact date of the introduction of Christianity into Britain is not known. Gildas, a British author of the sixth century, believes that it was as early as the year 37. There is no sound historical ground for asserting that the island was ever visited by an apostle. There is some ground for believing that the new religion was found there about 170, having come either from Rome.

When we reach the fourth century, we are treading on firmer ground. The records of the Council of Arles (314) actually give us the names of three bishops as present from Britain: Ebo-rius of York, Restitutus of London, and Adel-phus or Adelfius, either of Caerleon in Wales or of Lincoln. If the Caerleon theory be accepted, these sees would correspond with the Roman provinces into which the country was divided.

In the early days of eager controversy it is evident that the British church adhered in doctrine and discipline to the orthodox side, although, of course, there were some who were tainted with heresy. Indeed, there seems to be no doubt that Pelagius was a native of Britain. It is difficult to determine whether the Britons appealed to Rome or to the bishops of Gaul for assurance as to the true doctrine. To whichever the appeal was made, a matter not within the scope of this article to determine, the fact makes evident the anxiety of the British Christians to guard their orthodoxy.

After the overthrow of Pelagianism a more dreadful foe was encountered in the persons of the Saxons and Angles, whose successful invasion drove the Britons to the western part of the island, leaving the eastern part heathen.

The outlook for the church at the end of the sixth century was gloomy enough. Then it was that Gregory the Great, moved by the sight of the English lads in the slave market at Rome, undertook the conversion of the island and sent thither, in 597, Augustine and his fellow missionaries. Upon their arrival they found several bishops, whom they endeavored, but in vain, to bring into union with the church on the Continent. Much is due to them, for doubtless their mission wrought great changes in behalf of Christianity. By the death of the Christian King, Ethelbert of Kent (baptized by Augustine,

possibly through the influence of his Christian Queen, Bertha), and the succession to the throne of his irreligious son, Eadbald, the church received a severe blow, from which his conversion enabled it to rally. For many years her history was one of varied successes and failures. Largely by means of Irish and Scottish missionaries (among whom were Colomba, Aidan, and Finan) and of Mercians and Saxons, commissioned by Irish-born enthusiasts, the church had been planted more or less firmly in all the English kingdoms. At this time there was no national unity—no one Kingdom of England. Likewise there had not been as yet in the church any fusion of the British and Roman parties, each of them maintaining with great tenacity its own ecclesiastical uses. One of the chief points of dispute was the proper date for Easter (q.v.). At length, in the conference at Whitby (664), the Roman party gained the ascendancy. Thus it was made more easy for Theodore (who in 668 succeeded to the primacy and was one of the great men of his day) to unite the churches of the several kingdoms into what may properly enough be called the national Church of England. It follows, therefore, that the church is in no way indebted to the state for its original establishment and independence—being really the older institution of the two, by three centuries. Instead of the state establishing the church, it may more fairly be said that through its unification the church established the state. The Council of Hertford in 673 was not only the first ecclesiastical gathering, but the first assembly of any kind for the whole of England.

Theodore had not long succeeded in effecting this confederation before he began to act almost as though supreme over the other English bishops. In Wilfrid, Bishop of York, he met a prelate of consummate talents and determination, who would not allow the claims of any one to supremacy over him. When Theodore undertook, without his consent, although supported by King Egfrid, to carve new dioceses out of Wilfrid's jurisdiction, he at once appealed to the Bishop of Rome. This is the first of such appeals from England of which we have any record. He obtained from Agatho, the Roman Bishop, an order to Theodore for the rectification of these diocesan lines, with the threat of deprivation or excommunication for any clergyman or layman who might disobey the mandate. The King, however, imprisoned Wilfrid and allowed Theodore to go unchecked in his schemes of organization, for which he seems to have had uncommon genius. To him is attributed the origin of the parochial, or perhaps, rather, of the diocesan, system, as well as the first regular provision for the payment of tithes and offerings, not to the bishop, but to churches which the laity had built; and, further, of giving to such laymen the right of patronage, or of presenting clergymen to certain cures. After his death, the relations between the church and the state grew more distinct and defined, the latter agreeing to protect the former in its temporalities and supremacy. The church became more and more the religious function of the state and furnished the most efficient means for welding the different kingdoms into one.

But before this, as has already been shown, it had become the church of the nation, not by any act of the yet unformed nation, but by the manifold action of various individuals who had converted their several properties, however they lay, into parishes and had themselves provided

for the support therefrom of the required number of clergy. By universal custom, therefore,—not at first by law—this voluntary support was afforded; sometimes by payment in kind, sometimes in land, sometimes in tithes, and afterward by endowments and entailed tithes and testamentary donations. These benefactions have in many instances been preserved and continued through successive generations, and many similar ones have been added from time to time. It follows, therefore, that the church is no more indebted to the state for its endowment than for its establishment.

The period of the Danish inroads and conquests, which began about the close of the eighth century, was one of sore calamities to the church. These were somewhat mitigated by Alfred, who promulgated ecclesiastical laws, established schools, and provided books, some of them translations of his own. During the reign of Edgar (958-975) began the fierce and long-continued struggle between the monks and the parish clergy—the regulars and the seculars—in which Dunstan was so conspicuous. The influence of the secular clergy began, after his death, to overshadow that of the monks, who had at first been in the majority. Canute did something to restore the integrity and prosperity of the church, which had been seriously impaired by the scandalous conduct of bishops and others. With the accession of Edward the Confessor (1042), who had spent most of his life in Normandy, came a great influx of foreign prelates, with the habits peculiar to their own countries. This gave rise to much friction in ecclesiastical affairs, and disputes arose between the native and foreign clergy, in which Stigand, Archbishop of Canterbury (c.1052-70), took a prominent part. Edward's policy was carried out still more widely by William the Conqueror, who allowed the papal legates to depose Stigand and summoned Lanfranc, one of the most distinguished theologians of his day, to the vacant see. He and Ealdred, Archbishop of York, had a long and earnest dispute as to the primacy of Canterbury, which historically there was no room for York to dispute, and which was finally allowed at a council held at Windsor, in 1072, when the precedence of other sees was settled.

It was during the reign of the Conqueror that the civil and ecclesiastical courts were held separately—a change that tended to the benefit of both church and state. The same monarch caused the compilation of the Domesday Book, which showed that about half of all the lands of the kingdom were at the time in the hands of spiritual persons. In many cases the same possessions have been the property of the church for nearly 1000 years. It is also true that nearly all its present property was acquired either before the Norman Conquest or since the Reformation. The eleventh century was a period of great activity in building cathedrals and other churches, among which were those of Canterbury, York, Lincoln, and St. Paul's. Westminster Abbey was consecrated a few days before the death of Edward the Confessor, in 1065.

William Rufus openly encouraged simony, which the Conqueror had abhorred, and thus the church became greatly demoralized. Anselm appeared in due season to arrest its downward course and by his courageous and notable contests did much to prevent the King from

usurping its spiritual rights and privileges. To him is due also the credit of an earnest attempt to deal with scandals within the church. Anselm's defense of the church against William Rufus was but a prelude to the greater contest in Henry II's reign.

In the twelfth century the church began, in imitation of the Code of Justinian, to compile a code for itself. In the middle of the same century the great conflict was fought out between the church and the state as to the authority of the latter to deal with clergymen guilty of serious offenses. In this bitter contest Thomas à Becket played a very prominent part. He had been the confidential secretary of the Primate for some time and was Archdeacon of Canterbury at the time of the accession in 1154 of Henry II—"half monk, half soldier," as he was called. After serving for a while as chancellor, Becket succeeded Theobald as Archbishop of Canterbury in 1162, and it was not long before the controversy between the King and himself began which was only terminated by his cruel murder in his own cathedral in 1170. Partly because of the general horror following this crime and of the King's own remorse, and partly because of the elevation by the multitude of the Archbishop into the number of saints, the influence of the Constitutions of Clarendon (1164), which Becket refused to sign as restraining the authority of the church, in making the clergy amenable to the civil courts, was greatly impaired. Subsequently the King surrendered everything in this direction for which he had been contending, and it seemed that strife between the ecclesiastical and civil powers, after so portentous a conflict, was ended.

During this century and the following one the Crusades, which had first been preached in the days of Anselm, attracted many recruits from England, and the monastic spirit was evidenced in the establishment of military religious orders. The Knights Templar and the Knights of St. John were the only ones that obtained any foothold in England. The Crusades led oftentimes to the sale of lands to the monasteries that their owners might obtain the means for their expeditions, and not a few churches were built and restored in fulfillment of their pious vows.

After the martyrdom of Becket there was a long vacancy in the primacy, caused largely by the claim of Odo, the prior of Christ Church, Canterbury, that the election should be left to the monks. The power of the Roman Bishop had meanwhile been growing, partly from the desire of the kings to strengthen their disputed claims to the throne by obtaining the powerful influence of the Pope, as also from a desire to have him side with them against the recalcitrant bishops and other clergy. During the reign of King John the contest between the church and the throne broke out anew over the appointment of Stephen Langton to the see of Canterbury. John obstinately refused to acquiesce in the Pope's decision favoring Langton's election to the see, and deputed the papal envoys sent to adjust the difference between pontiff and sovereign. The Pope in consequence laid an interdict upon the whole kingdom, which lasted more than six years, and John only yielded under threat of deposition.

Stephen Langton, Archbishop of Canterbury (died 1228), stood with the barons against both monarch and pontiff in the demand for Magna

Charta. For the Magna Charta, extorted from King John, England is more indebted to the church than to any other agency. Indeed, it is doubtful whether without its aid any such guaranty of liberties would then have been obtained. Translated into English, its first clause runs: "The Church of England shall be free, and hold its right entire, and its liberties inviolate."

During the reigns of the thirteenth century there was much controversy over, and protest against, the frequent levies of tallage, an ecclesiastical tax for the support of the papal see. The popes resorted to this tax at large to replenish their exhausted coffers. So frequent were these calls that the English clergy found them very burdensome and protested vigorously, but to very little effect. Numerous protests also arose in England over the papal nominations of foreigners to English benefices, which had resulted in many abuses.

The clergy, as a rule, were treated harshly by Edward I, whose pecuniary exactions from them led to continued irritation. Under Edward II the limits between the ecclesiastical and civil jurisdictions were defined by the statute called *Articuli Cleri*. By the statute of *Præmunire*, passed in the reign of Edward III (in 1351), the nationality of the Church of England was for the first time recognized and guaranteed by civil law. To this period belong Wiclif and the Lollards, whose influence upon the Reformation is well known.

Throughout the fourteenth century the popes continued to assert their authority in various ways, but the great schism of the West, which divided Christendom over the claims of rival popes, greatly weakened the prestige and authority of the Roman pontiffs in England as well as elsewhere in Europe. In England the duration of the schism had allowed the statutes of *præmunire* to be executed with but little opposition. The ecclesiastical confusions resulting from this schism contributed much to prepare the way for the religious changes of the sixteenth century. In treating of that period technically styled the Reformation (q.v.) one must not confine the review to the reign of Henry VIII. The movement extended also over the three subsequent reigns of Edward VI, Mary, and Elizabeth. That some kind of reformation was greatly needed, in the interests of both church and state, was generally admitted. There was, however, much difference of opinion as to how it could best be accomplished. Where so many were interested in the work, and with such a variety of motives, it is not surprising that the results should have had about them a mixture of good and bad. Among the chief points to which the reformers took exception were the papal supremacy, enforced clerical celibacy, worship of images, invocation of saints, indulgences, compulsory auricular confession, and transubstantiation. When Henry VIII became wearied of the delay on the part of the Pope (Clement VII) in granting him a divorce from Catharine of Aragon, his brother's widow, he appealed to Cranmer, the newly appointed Archbishop of Canterbury, who, acting under the Statute for the Restraint of Appeals passed by Parliament in 1533, in concurrence with many divines and casuists and several European universities, declared the marriage null and void (1533). His opinion was also approved by the English Convocation. Henry then married Anne Boleyn, and pres-

ently the Pope pronounced his first marriage lawful and excommunicated him for adultery. The King now turned a deaf ear to Rome's anathema, and Parliament proceeded, under royal command, to enact laws formally renouncing the papal supremacy. Convocation (which then met simultaneously with the Parliament, that ecclesiastical laws might receive the joint sanction of the two bodies) concurred in this action. An appeal was made from the Pope to a general council, and in its course the assertion was made that "the Bishop of Rome hath not any more authority conferred upon him by God in Holy Scripture, in the realm of England, than any other foreign bishop." Doubtless, some of the clergy were moved to this action not so much by their real sentiments as by dread of death if they demurred. Under the auspices of Cranmer, and with the King's approval, an English version of the Bible was published.

The monarch's worse side was shown in his dissolution of the monasteries and the squandering upon himself, the nobles, and the gentry of the larger part of the wealth which thus fell under his control. Hence, under bereavement of so many sources of charity, came those formidable risings of the people which more than once threatened the royal armies with defeat. Indeed, the Reformation was hindered more by the selfishness and treachery of its pretended friends than by the opposition of its enemies.

The reign of the youthful and pious Edward VI (1547-53) was long enough to allow a vast amount of sacrilegious plunder. The first book of *Homilies* was set forth in 1547, and the next year an *Order for the Communion* in English. This was followed by the first English Liturgy, which was used for the first time on Whit-Sunday, 1549. The second book of Edward was issued in 1552, but never received due authorization. In the same year the Forty-two Articles of Religion were set forth, but they were not sanctioned by Convocation until 1563, when they were reduced, with some modifications, to 39. Parliament revoked the Six Articles of Henry, authorizing clerical marriage, enjoining communion in both kinds, prohibiting solitary masses, and abolishing divers usages and ceremonies which were then believed to foster superstition and idolatry. The death of Edward, in 1553, put both the Reformation and the reformers to a severe test. Under Mary the Pope was once more acknowledged, and the peculiar doctrines of Rome were reinstated, though Mary retained the title "Supreme Head." Cranmer, Latimer, Ridley, and many others sealed their convictions with their blood. Upon Elizabeth's accession (1558) this work of reconstruction was continued under more favorable circumstances. The new Queen and her Parliament showed clearly enough their determination not to push ecclesiastical changes to the lengths some of the reformers demanded. She had no sympathy with the eccentric course of the foreign reformations. Under their influence some of the English reformers began to look upon what had already been completed as but partial, and introductory to other changes thought by them to be equally essential. From this source arose the prolific evils belonging to that Puritanism which wrought as great damage as the Erastianism with which much of the previous work had been accompanied. Elizabeth



herself had little religious sentiment, and questions of state determined her policy to abet and foster the Reformation movement. But she had no liking for the Puritanical spirit, which boded a curtailment of the prerogatives of the throne and an assertion of rights which might trench upon the privileges of Tudor absolutism. While seeking to hold Puritanism in check, nevertheless, her ministers understood its value to the Queen and judiciously maintained a balance between the retroactive and extreme reforming parties. There was still considerable religious controversy, in which "the judicious Hooker" took a prominent part. Archbishop Parker—a thoroughly loyal prelate, a scholarly man, and an efficient organizer—belongs to this same period. The almost unanimous conformity—less than 200 clergymen quitted their benefices at Elizabeth's accession—was, no doubt, due in part to the severe penal laws which the Queen enforced. There was no visible nor formal schism until the Pope, finding Elizabeth deaf to his appeals and determined in her refusal to acknowledge his supremacy, formally excommunicated her and absolved her subjects from allegiance to her. Thus encouraged, the papal adherents began to separate themselves into a distinct community in the year 1570. They had, however, for nearly a century no bishops of their own, except for six years, when a titular bishop, sent from Rome, resided in England.

The Puritans, failing to bring the church to their way of thinking, cut themselves off from her communion and set up communities of their own. Having, notwithstanding Archbishop Whitgift's earnest struggle against them, secured a majority in both Houses of Parliament, they passed an ordinance to establish a Presbyterian form of government. The Prayer Book and episcopacy were practically abolished for a season, despite the brave and determined protests and opposition of nonconforming churchmen. Convocation in 1563 settled and subscribed the Confession of Doctrine which has ever since remained an authoritative apologetic document of the English church. It also set forth, with synodical authority, a second Book of Homilies.

James I did not prove very serviceable to the Puritans, although he was not always reliable in his support of the church. He restored the episcopate to his native Scotland and ordered a revision of the English version of the Holy Scriptures. The reign of Charles I and Archbishop Laud—for the King and prelate may rightly enough be joined together, such was their agreement generally in character and policy—was a period of great unrest to the church. Their devotion to her interests and their sacrifices in her behalf cannot well be doubted or belittled, however much it is to be regretted that the one was lacking in firmness and the other in conciliatoriness. Their unselfishness and moral courage joined them together again in an honorable martyrdom.

The period of the Commonwealth may well be described as one of religious anarchy; and yet with such men as Cromwell in power it may be that this very lawlessness was more to the advantage of the church than any system which they could have put into operation. Of the varied mischief and cruelty to the church perpetrated during this period, there was ample evidence everywhere; and the senseless and pro-

fane damage done by or under Cromwell's order is still visible in cathedrals and churches throughout the kingdom.

On the restoration of Charles II (1660) the persecutions and other outward disasters to the church came substantially to an end; and she began once more to go on with her work quietly and prosperously. No period, perhaps, furnished a richer company of learned and godly divines, among whom may be mentioned Sanderson, Jeremy Taylor, Barrow, Pearson, and Bull, who were worthy successors of Jewel, Hooker, Andrewes, and Hammond.

The peace of the church was again disturbed by the efforts of James II to reestablish the papal supremacy. His subjects were so generally indignant at these efforts that the King was driven from his throne (1688). It is calculated that at this time nineteen-twentieths of them were, at least nominally, adherents of the church. William and Mary were declared King and Queen. Hence arose the nonjurors—bishops and others who refused to swear allegiance to the new dynasty. The greatest among them were Ken and Sancroft. Much controversy ensued; but eventually most of the nonjurors returned to the church and were reconciled to the succession. Sheldon had perhaps greater and more uncontrolled power than any who had preceded or have followed him in the primacy. He superintended and to a large extent dictated the reconstruction of the churches of England, Scotland, and Wales, after the Great Rebellion.

With the formation, in 1698, of the Society for Promoting Christian Knowledge, and in 1701, of the Society for the Propagation of the Gospel in Foreign Parts, and the care of Queen Anne, the church began her history in the eighteenth century under most favorable circumstances. The clergy attained to an influence never before surpassed, their great zeal and disinterestedness contributing in no small measure to this result. The advent of George I boded no good to the church. Before long, Bishop Hoadley's heterodox writings brought much disquiet and harm. They were condemned by Convocation, for which act it was summarily prorogued—to reassemble, without legislative functions, only in the middle of the next century—the foreign prince's ministers treating the matter as one of a political character. How many evils resulted from the long-continued silence of the church's greatest council it is impossible to say, but it was a blow from which it took many years to recover. Walpole, who was so influential with the monarch, encouraged a policy of quietness, and, by practically preventing the discussion of abuses, became a very questionable benefactor to the church.

Various causes tended to prevent the fair prospects that marked the opening of the eighteenth century from being realized at its close. Prominent among these may be mentioned the system of pluralities and nonresidence and the abuse of patronage. The church was now somewhat in a transition state. Not being compelled any longer to fight for her very existence and nationality, her members fell—not unnaturally, perhaps—into something like lethargy. From this condition she was aroused in the middle of the century by such men of intellectual ability as Butler, Waterland, Berkeley, Warburton, and Conybeare, as also by the saintly life of Wilson, Bishop of Sodor and Man, and the devout writings of William Law. Tillotson, although be-

longing to the previous century, was still influential through his writings.

It is not necessary to trace the history, in this connection, of what is known as Methodism (q.v.), but it must be taken into consideration in forming a correct idea of the church's real condition at this period. While both John Wesley and his brother Charles never left the communion of their mother church, and uttered the most severe and solemn denunciations against any of their followers who should do so and should dare to set up a new organization outside of the church, yet doubtless they would have been more enthusiastic churchmen than they were (Charles was more consistent than John), had there been more sympathetic appreciation of their devout aspirations and unselfish labors.

What is known as the Evangelical school arose at the close of the eighteenth century and was a dominant factor in the church for a full generation. Some of its most famous adherents were Cecil, Venn, Milner, Newton, and Simeon. It met an undeniable want and contributed much to the advantage of the church. The Tractarian (sometimes called, from its source, the Oxford) movement—so named from the publication from 1833 to 1841 of a series of "Tracts for the Times"—did very much to arouse the latent energy of the church and to prepare her for availing herself of her great opportunities. Pusey, Keble, Newman, Williams, are names that stand for the restoration of a catholic faith not less essential to the church than the gospel truths which the others rightly magnified.

The remainder of the nineteenth century was filled with events of great interest and importance and with characters illustrious for their talents and virtues. It is completely covered by the reign of Queen Victoria. During the period there were constant heated controversies over such matters as the Catholic Emancipation Act (1827 and later), the disestablishment of the Irish church (which went into effect in 1871), the removal of disabilities from Jews and atheists, the *Essays and Reviews* (containing nothing particularly new, but attracting wide attention because of their distinguished authors), the Gorham Judgment as to baptismal regeneration, the views of Bishop Colenso for his views of the inspiration of Holy Scripture, the Public Worship Regulation Act (1874), the Lincoln Judgment dealing with ceremonial acts in the celebration of Holy Communion, the unsuccessful attempts to disestablish the church in Wales, and religious education in the nonconformist schools. The Royal Commission on Ecclesiastical Discipline, appointed in 1904, presented a unanimous report in July, 1906, recommending among other things modification of the law with a view to greater elasticity; reconstitution of the ecclesiastical courts, with abolition of bishop's veto on prosecutions, and an increase in the number of bishops.

In its missionary enterprises of all kinds, in its charitable and educational schemes, in the multiplication and endowment of new dioceses and parishes, and in the development of the spiritual side of its life, no period can show more zeal and liberality. With all this energy there would seem to be a growing charity among those that differ honestly from each other.

That there are these differences appears further from the existence not only of what are called the High and Low Church parties, but

also of what is known as the Broad Church party, the progenitor of which was Samuel Taylor Coleridge, and which has numbered among its members Julius Charles Hare, Whewell, Thirlwall, Arnold, Stanley, Maurice, Kingsley, and Robertson.

Other names—such as Samuel Wilberforce, Liddon, Palmer, Church, Christopher Wordsworth, Lightfoot, Stubbs, Bright, Westcott, Magee, Butler, Hook, Burgon, Neale—will recall men who, as prelates, preachers, scholars, and pastors, have been worthy of the best days of the church.

For such an organization as the Church of England there is an amazingly small amount of law. There is no formal document styled constitutions. Of canons—enacted at various periods, many of them before the year 1604—there are nearly 150. Parliament may, with the sanction of the sovereign, impose upon the church any law. Convocations (q.v.) are called for the purpose of discussing ecclesiastical matters and of advising the crown concerning them. Their discussions, no matter how influential, cannot directly eventuate in law. The diocesan conferences and synods (the former composed of elected clergymen and laymen, the latter of clergymen alone) may likewise take action binding upon the conscience. The houses of laymen seek to give counsel to the convocations in matters of practical importance. The Representative Church Council, created in 1905, consists of three houses, formed by members of the convocations and houses of laymen of the provinces of Canterbury and York. The functions of the Church Congress, a wholly unofficial body, are confined entirely to the consideration of ecclesiastical topics.

There are two archbishops (q.v.). The Archbishop of Canterbury, entitled Primate of All England, had under him, in 1914, 59 bishops, with 29 dioceses. The Archbishop of York had 18 bishops, with 10 dioceses. Next in dignity to the bishops are the deans and archdeacons (q.v.). Then follow canons, prebendaries, rectors, vicars, and curates. The right of presentation to parochial benefices is almost wholly in the hands of certain clerical or lay persons or bodies called "patrons" of the "living." (See PATRONAGE, ECCLESIASTICAL.) There are voluntary organizations, called church boards or parochial councils, who act as advisers and helpers to the clergymen and churchwardens. The vestry of each parish is a body whose membership and meetings are open to all ratepayers, and whose functions are largely civil. They have, among other things, the settlement of church rates, which are voluntary and cannot be recovered by law.

Because of the existence of large endowments, many of the churches are wholly or partially relieved of the necessity of contributing to the support of the clergy and are therefore the more free to give to other ecclesiastical objects. The income for general purposes in 1913 equaled £7,900,230. The principal items of receipts were: maintenance of church services, £1,628,356; church buildings, £1,119,289; foreign missions, £933,981; maintenance of assistant clergy, £863,802; home missions, £814,808; support of the poor, £455,659; philanthropic work, £609,010.

As to organized work, there would seem to have been but little, outside of the universities and schools, until the beginning of the eighteenth century. The Society for the Propagation of the

Gospel and the Church Missionary Society include in their operations almost all the heathen parts of Asia and Africa as well as all the colonies of Great Britain. Provision is regularly made, by means of temporary or resident chaplains, for services of the church in many towns and villages on the continent of Europe where English-speaking people are found in any considerable numbers.

In home-mission work the agencies are almost countless. The army, the navy, seamen, drunkards, fallen women, friendless girls and lads, the navvies, the hop pickers, the deaf, dumb, and blind, the Jews, the waifs and strays and uneducated—all these and many other classes are provided for by organizations more or less national in their character. There exist also orders of a semimonastic character composed of men, of women, or of both, by means of which much of the church's work is done. Sisterhoods (q.v.), of which a number have been formed, were first organized in the year 1845, under the direction of Dr. Pusey. In 1913 there were in all 14,019 benefices or cures and about 27,000 clergymen. See **ANGLICAN COMMUNION**; **REFORMATION**; **PRAYER BOOK, COMMON**; **BISHOP**; **TITHES**; **ESTABLISHMENTS, ECCLESIASTICAL**; **APOSTOLIC SUCCESSION**.

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**ENGLAND'S HELICON.** An anthology of English poems, edited by John Bodenham in 1600 and reissued in 1812. It contains 150 poems by the leading writers of the day.

**EN'GLEHEART, GEORGE** (1752-1829). An English miniature painter. He was born at Kew and studied under George Barret and Sir Joshua Reynolds. He first exhibited at the Academy in 1773, and between that time and 1813, when he retired, he painted about 4353 miniatures. He usually painted on ivory, though sometimes he used enamel. His miniatures are careful in draftsmanship, good in color, and show fine power of characterization. In 1790 he was appointed miniature painter to King George III, whom he portrayed 25 times; and as most of the important personages of the court were numbered among his sitters, he entered into serious rivalry with the famous Richard Cosway. He also made miniature copies of many of Reynolds's paintings.—JOHN COX DILLMAN ENGLEHEART (1783-1862), his nephew and pupil, was also a popular miniature painter until ill health obliged him to retire from the profession in 1828. A fine collection of the works of both artists including

a miniature of George III. painted by himself, is in the J. P. Morgan . . . Metropolitan Museum, New York). Consult Williamson and Engleheart, *George Engleheart* (London, 1902).

**EN'GLEMANN'S TUNA.** See **PRICKLY PEAR**.

**ENGLER, ɛŋ'glər, EDMUND ARTHUR** (1856- ). An American educator, born in St. Louis, Mo. He was educated at Washington University (A.B., 1876; A.M., 1879; Ph.D., 1892), where he was professor of mathematics from 1881 to 1901, dean of the School of Engineering from 1896 to 1901, and secretary and treasurer of the university after 1911. Between 1901 and 1911 he was president of Worcester (Mass.) Polytechnic Institute. In 1889 he was a member of the Washington University eclipse expedition to Norman, Cal. He also served as chairman of juries of awards at the Buffalo Exposition in 1901 and at the St. Louis Exposition in 1904. From 1898 to 1901 and in 1912-13 he was president of the St. Louis Academy of Science. His publications consist of many scientific articles contributed to the magazines.

**ENGLER, ɛŋ'glər, HEINRICH GUSTAV ADOLF** (1844- ). A German botanist, born at Sagan and educated at Breslau. He was professor of botany at the University of Kiel from 1878 to 1884, at Breslau from 1884 to 1889, and was appointed in 1889 to the same chair at Berlin, where he was also made director of the Botanical Gardens. His chief botanical interests came to be taxonomy (classification) and plant geography. In 1881 he became editor of the *Botanische Jahrbücher*, which is the leading periodical dealing with taxonomy, the history of plants, and plant geography. He initiated and carried forward successfully several extensive publications, viz., *Die natürlichen Pflanzenfamilien* (in collaboration with Prantl), a systematic presentation of all of the plant genera of the world; *Das Pflanzenreich*, a presentation of all of the species of the world; *Die Vegetation der Erde* (in collaboration with Drude), a detailed account of the plant geography of different regions of the world. Perhaps his most notable publication is the *Syllabus der Pflanzenfamilien*, in which there is a reorganization of the scheme of classification. This has been adopted almost universally, so that the "Engler sequence" obtains in almost all manuals of botany.

**ENGLES, WILLIAM MORRISON** (1797-1867). An American author, born in Philadelphia, Pa., and educated at the University of Pennsylvania. In 1818 he became a Presbyterian missionary in the Wyoming valley and, after holding a pastorate of 14 years in Philadelphia, in 1834 became editor of the *Presbyterian* and in 1838 editor for the Presbyterian Board of Publication, of which he became president in 1863. He was moderator of the Presbyterian General Assembly in 1840. His works include: *Records of the Presbyterian Church* (1840); *English Martyrology* (1843); and the *Sailors' Companion* (1857) and the *Soldiers' Pocketbook* (1861), which attained a circulation of 300,000, during the Civil War.

**ENGLEWOOD, ɛŋ'g'l-wud.** A city in Arapahoe Co., Colo., 6 miles south of Denver, with which it is connected by trolley. It is in an agricultural, dairying, and stock-raising region, and contains the National Swedish Sanitarium and the Molkeray Sanitarium. There are also many fine homes. Pop., 1910, 2983.

**ENGLEWOOD.** A city in Bergen Co., N. J., 14 miles by rail north of Jersey City on the

Erie Railroad (Map: New Jersey, E 2). It lies on the gentle western declivity of the Palisades of the Hudson, and is purely residential. The city contains a hospital and a public library. The township of Englewood was set off from the old township of Hackensack in 1871. Englewood was incorporated as a city in 1895, but the act of incorporation was declared unconstitutional and it was reincorporated in 1899. Pop., 1900, 6253; 1910, 9924; 1914 (U. S. est.), 11,487.

**ENGLISCH**, *ëng'lish*, JOSEPH (1835– ). An Austrian surgeon, born at Freudenthal, Austrian Silesia, and educated at the University of Vienna. In 1871 he became one of the physicians in chief at the Rudoliftstiftung, Vienna, and in 1892 was made professor of surgery at the Vienna University. He became a distinguished authority on genitourinary diseases. Among his numerous publications on rupture, genitourinary diseases, malformation of the sexual organs, and cognate subjects, are: *Ueber Ovarialkernien* (1871); *Zur Radikalbehandlung der Eingeweidebrüche* (1878); *Ueber abnorme Lagerung des Hodens ausserhalb der Bauchhöhle* (1885); *Ueber angeborene Penisfisteln* (1892).

**ENGLISH**, GEORGE BETHUNE (1787–1828). An American author and adventurer. He was born at Cambridge, Mass., graduated at Harvard, became a member of the Boston bar, and studied theology. He soon began to doubt the truth of Christianity, however, and published in 1813 *The Grounds of Christianity Examined*, a work favoring Judaism, which called out Edward Everett's *Defence of Christianity* (1814). He subsequently edited a paper in the West and then served in the Mediterranean as a lieutenant of marines. In 1820 he resigned his commission to serve under Ismail Pasha in Egypt, and won distinction as an officer of artillery in the expedition against Sennar. He was subsequently agent for the United States government in the Levant, but returned home in 1827. He published *Narrative of the Expedition to Dongola and Sennar* (1822).

**ENGLISH**, THOMAS DUNN (1819–1902). An American physician and man of letters, born in Philadelphia, Pa. English, whose family name is a corruption of Angelos, studied medicine in his native city, and graduated at the University of Pennsylvania Medical School in 1839. He speedily gave up the practice of medicine for law, however, and was admitted to the Philadelphia bar in 1842. In 1844 he embarked in journalism in New York and in 1845 established the *Aristidean*. After 1859 he practiced medicine at Newark, N. J. A Democrat in politics, he was a member of the New Jersey Legislature in 1863–64 and represented his district for two terms (1891–95) in the United States House of Representatives. He also gave much attention to literature, aside from being a magazine editor and journalist. The following are the principal titles of his works, chiefly novels and poems: *Zephaniah Doolittle* (1838); *Walter Woolfe* (1842); *MDCCLXIV: or, The Power of the "S. F."* (1847), a semipolitical novel; *Poems* (1855); *Ambrose l'ecit: or, The Peer and the Printer* (1869); *American Ballads* (1882); *Boy's Book of Battle Lyrics* (1885); *Jacob Schuyler's Millions* (1886); *Select Poems* (1894), ed. by his daughter; *Fairy Stories and Wonder Tales* (1897); *The Little Giant, The Big Dwarf, and Two Other Wonder-Tales* (1904). He is popularly known by the song "Ben Bolt," published

in Willis's *New York Mirror* in 1843 and never highly ranked by him among his poems. As set to music by Nelson Kneass, this became widely popular in both England and America and after a temporary obscurity was later revived through its introduction by Du Maurier into the novel *Trilby* (1894). "The Gallows Goers," treating of capital punishment, also had wide circulation.

**ENGLISH**, WILLIAM HAYDEN (1822–96). An American politician. He was born at Lexington, Ind.; studied law, and in 1843 was chosen clerk of the Indiana House of Representatives. He was secretary of the State Constitutional Convention which framed the Constitution of 1850, and in the following year was made Speaker of the House under the new Constitution. From 1853 until 1861, when he retired from active political life, he was a Democratic member of the Federal House of Representatives. His chief title to distinction was his unanimous nomination for the Vice-Presidency of the United States by the Democratic National Convention, in 1880, on the ticket with Gen. Winfield S. Hancock. He is author of the congressional measure relative to the admission of Kansas as a State, known as the English Bill. He published *The Conquest of the Country Northwest of the River Ohio, 1778–83, and Life of George Rogers Clark* (2 vols., 1896)—a somewhat uncritical work which, however, contains a mass of valuable material. Consult Keyser, *The Life of William H. English, the Democratic Candidate for Vice-President of the United States* (Philadelphia, 1880).

**ENGLISH CHANNEL** (Fr. *La Manche*, the sleeve). A reach of the North Atlantic Ocean separating England from France, and commonly called THE CHANNEL, the most important marine thoroughfare in the world (Map: Europe, C 3). It is connected with the North Sea by the Strait of Dover, 20 miles wide at its narrowest point. From this strait it extends west-southwest for 280 miles, and joins the Atlantic Ocean at the Chops, between the Scilly Isles and Ushant Isle, where the breadth is 100 miles. The average breadth is 70 miles; the greatest breadth is 140 miles—from Sidmouth to Saint-Malo. The average depth of the eastern half reaches about 200 feet; at the Strait of Dover the depth varies from 6 to 120 feet, while in the western half the depth averages about 300 feet, and in places even exceeds 500 feet. A coarse gravel covers the bottom. The Channel occupies about 30,000 square miles, and contains the Scilly Isles, Channel Islands, Isle of Wight, Ushant Isle, and many islets and rocks, especially off the coast of Brittany. The Seine is the largest river which flows into it. Pilchard, mackerel, and other fish, as well as oysters, abound. The English coast line, extending from Dover to Land's End, is 390 miles long, and the French, extending from Calais to Ushant, 570 miles. The chief English seaports on the Channel are Falmouth, Plymouth, Southampton, Portsmouth, Brighton, Folkestone, and Dover; the chief French ports are Cherbourg, Havre, Dieppe, Boulogne, and Calais. High tides, with a rise of from 37 to 42 feet, prevail on the south shore. The phenomenon of double high water is seen between Poole and Southampton, the tide coming in first by the Solent, and again by Spithead three hours later. The sea is generally rough and unpleasant for travel, owing to the contrary currents. Plans for making a

continuous connection between London and Paris across the Channel have been numerous; the most common include tunneling, bridging, and running train ferries. The last tunnel project, in 1907, was opposed by the government. The *Oceanus Britannicus* of the Romans, the Channel has been the scene of many important historical events, including the destruction of the Spanish Armada, the battle of La Hogue, the fight between the *Kearsarge* and the *Alabama*, etc.

**ENGLISH CONSTITUTION.** See PARLIAMENT.

**ENGLISH DIALECTS.** See ENGLISH LANGUAGE; SCOTTISH LANGUAGE AND LITERATURE.

**ENGLISHERY, or ENGLSCHERIE.** The fact of being an Englishman, and not a Dane. The term refers to the curious exemption of a community in which an Englishman was found secretly slain, from the burden of making satisfaction for the murder. This ancient principle of the liability of the family, or mark, for the deeds of violence of its members is said by early English writers to have been introduced into England by Canute, the Dane (1015 A.D.). Probably it had long existed, and had become nearly obsolete by his time, but was revived by him as a measure for the protection of his own followers from native violence. The community indicted of the crime might make a "presentment of Englishery"—i.e., might set up a formal plea that the victim of the crime was an Englishman; which being established to the satisfaction of the court, the matter was left to the local law and the community was discharged of its indictment. The practice was maintained for many years after the reason for it had passed away, and it was not till the twenty-first year of Edward III (1348) that presentment of Englishery was abolished by act of Parliament. Consult Stephen, *History of the Criminal Law of England* (London, 1883).

**ENGLISH HARBOR.** An important harbor on the south coast of Antigua, West Indies, one mile from Falmouth. It is the site of a British naval station, and has a good harbor.

**ENGLISH HORN.** The cor anglais (q.v.). See Plate of MUSICAL INSTRUMENTS.

**ENGLISH LAND.** See ENGLISH PALE.

**ENGLISH LANGUAGE.** The chief medium of communication in the British Empire and the United States. It is the language used originally by the Teutonic tribes that invaded the island of Britain during the latter half of the fifth century. It belongs historically to the western branch of the Teutonic languages (q.v.) and to the Low German subdivision of that branch, being most closely allied to the Frisian (q.v.). In spite of the composite character of its vocabulary, less than one-third of which is native, modern English is still an essentially Germanic language—the real nature of a language is determined not by its vocabulary, but by its grammatical structure. The grammatical forms of English, its verbal system, the declension of its nouns and pronouns, the comparison of its adjectives and most of its purely relational words, such as simple adverbs, prepositions, and conjunctions, are native. All the numerals, too, except *second* and those above a thousand, have always been in the language. The changes that have taken place in English grammar have been due to the leveling of old inflections, not to the introduction of new ones.

In tracing the growth of the English language, the history is usually divided into three leading periods: The Old English period (449 A.D. to 1100 A.D.), the Middle English (1100–1500), and the Modern English period (1500 to the present time). But the name of the first period is now criticized by an increasing number of scholars, who affirm, not that English was always English, and never Anglo-Saxon; that the fact that it was inflected in the period before the Norman Conquest, and lost most of its inflections in later times, is no reason for speaking of it as if it were two different languages; and that we have no warrant in the usage of the inflected period for calling our forefathers or their speech anything but English. The term Anglo-Saxon did not come into use until in the seventeenth century, at the time of the revival of an interest in our earliest literature, so that the word is not only misleading, but has not even the merit of antiquity. The term Old English, furthermore, is in keeping with the classification of the other Germanic languages. But as the term Anglo-Saxon has been so long in common use and is clearly understood by all readers, whereas the more exact term Old English is sometimes incorrectly applied to later periods, possible confusion is avoided by retaining the first.

As early as the fifth century, Teutonic invaders from the Continent settled in Britain and drove the original Celtic-speaking inhabitants to the north and west of the island; so that before the battle of Hastings (1066) the tongue of the conquerors had been spoken in England for at least six hundred years. The final absorption, after numerous conflicts, by the kings of Wessex, or of the West Saxons, of the various states of the "Heptarchy," in the ninth century, went far to make the ruling speech of the land identical with that of Berkshire and Hants, the recognized centre of the predominant sept. The use, besides, of this southern speech as the chief instrument of literary communication was permanently confirmed by the influence of King Alfred, a native of Berks. Few existing monuments of the language remain that permit us to go further back than the time of this literary monarch; yet, from the writings of Cædmon, who was a North-Anglian, and a few ecclesiastical manuscripts from the Kingdom of Northumbria, which extended from the Humber to the Firth of Forth, it has been generally concluded that at least two principal dialects must have been used in the island—a northern, including Mercian and Northumbrian, and a southern, including Kentish and West Saxon. The northern, or Anglian, was to some extent marked by Scandinavian features. This is not at all surprising if we admit that the Angles came from that corner of Schleswig still called Angeln, or indeed from any region north of the Elbe, aside from the influence of the Danes. It should be noted, too, that many works that are known to us in a West Saxon form were originally written in Northumbrian, as *Bœowulf* and Bede's translation of the *Ecclesiastical History of Britain*. It was the custom of mediæval scribes to use their own dialect in copying works from another.

It is important to notice here that neither the Anglian nor the Saxon borrowed much from the language of the conquered Britons. The largest single class of Celtic words in Anglo-Saxon is in connection with geographical names, such as

*Aberdeen*, mouth of the Dee, *Inchcape*, island cape, and *kill*, meaning church, in *Kildare*. Only 10 common nouns borrowed from Celtic in Anglo-Saxon are given by Skeat (*Principles of English Etymology*), among these being *bannock*, *cart*, *down*, *mattock*. It is possible, however, that other Celtic words were in use that have not been preserved in literature; but most of those of Welsh, Gaelic, or Irish origin that are found in modern English are comparatively recent borrowings. Very few, in fact, go back as far as the Middle English period. A few Latin words were evidently introduced through the Celtic. Some of these are geographical names, having different forms of the word *castra*, camp, as the last part; among the others may be noted *lake*, *mount*, *street*, *wine*. A few Latin words were brought to Britain from the Continent, where the Teutons had already come into contact with Roman culture. It may be inferred that all Latin derivatives found in Anglo-Saxon and in other early Germanic languages are preinsular. Among these have been suggested *chalk*, *coulter*, *mint*. But by far the largest borrowing of Latin words during the Anglo-Saxon period came as a result of the introduction of Christianity in Kent in 597. Not only ecclesiastical words directly connected with the new faith, but many general words found their way into the language. The total number of Latin words introduced at this time is estimated by Skeat at 140. From among these may be taken the following examples: *altar*, *mass*, *pricst*, *psalm*, *temple*, *kitchen*, *palm*, *pear*, *tunic*. It should be noted that several of these words are of Greek origin. Not a few Scandinavian words were borrowed, mainly as a result of the Danish invasions. Several of these occur for the first time in the accounts of the engagements between the English and the Danes given in the *Anglo-Saxon Chronicle*. Thus *earl*, first applied only to Danish leaders, later took the place of the English *alderman*. Other words are *husband*, *knife*, *take*, *window*. Great difficulty is often experienced in determining the Scandinavian element in Anglo-Saxon, owing to the close resemblance between Northumbrian and Norse.

The early part of the Middle English period, sometimes called Semi-Saxon, is a period of transition, and, like every transition era, it is marked by confusion. The absence of any recognized standard dialect added greatly to the confusion. The monks of the time, accustomed to the use of mediæval Latin, had in a great measure forgotten the grammar of their native language and, when they attempted to write it, did so very badly. The *Chronicle*, which in its latest forms comes down to 1154, and Layamon's *Brut*, written about 1190 or 1200, exhibit traces of the breaking up of the grammar. During the Middle English period all the important changes took place that resulted in transforming English from a highly inflected into a practically uninflected language. It should be remembered, however, that the tendency of English to substitute an analytical for a synthetical structure, i.e., to indicate syntactical relations by the use of particles and by the order of words in the sentence, is not peculiar to our language. Among the Scandinavian languages, Danish and Swedish belong now to about the same stage as English, and Dutch is no less distinctly analytical. German, on the other hand, is still a highly inflected language. Beginning with the noun in English, we find that as early as 1200 the three or four

cases in the singular had been reduced to two in the majority of nouns, and that in the plural the common form in *es* had been adopted. During the latter part of the period almost all nouns were declined in practically their present manner. The apostrophe in the genitive singular was introduced to indicate the original *e* of the ending, and it was later extended to the plural. The simplification of the declension of the noun was effected by two principles—one phonetic, the weakening of all the vowels of the endings to *e* and the dropping of final *n*, which reduced all vowel endings to the one form; the other logical, the principle of analogy, by which the various declensions of Anglo-Saxon were reduced to the most prominent one, the strong masculine ending in the plural in *as*, later weakened to *es*. Only one original weak plural, *oxen*, has survived in Modern English, *kine* and *brethren* being later formations. Several representatives of the so-called mutation class, or nouns showing a modification of the root vowel in the plural, as *man*, *men*, *foot*, *feet*, are still found, and there are also a few nouns having the same form in the plural as in the singular, as *deer*, survivals of Anglo-Saxon neuters. Along with the leveling of inflections there has been a change from the grammatical to the natural gender. This was a necessary result of the loss of distinctive inflectional endings. In the adjective there has been a complete loss of inflections, since comparison belongs, not to inflection, but to composition. In this respect English has gone further than Danish, in which a distinctive form has been retained for the definite and the plural. The definite form of the adjective is still used by Chaucer. In the declension of the pronoun the dual number has been lost, and the dative and accusative have been reduced to a common form, derived in most instances from the dative. One entirely new form, *its*, has been developed in the seventeenth century, the original genitive being *his*, which is the only form used in the King James translation of the Bible. The relatives *who*, *which*, *that*, were introduced in the Middle English period, and the plural of the demonstrative *they* was substituted for the original plural *hi* of the third personal pronoun. In the conjugation of the verb the principal change has been in the loss of about two-thirds of the strong class, most of them passing over to the weak conjugation. With a very few exceptions all verbs borrowed from foreign languages during the Middle and Modern periods are weak. This tendency is the result of analogy. The conjugation has also been greatly simplified by the loss of endings and the use of a common form for the singular and plural of strong verbs.

It will be seen from this brief survey that Modern English, although it has greatly simplified its inflection, is not a wholly analytical language. In the nouns the process has been carried further than in the pronouns, since in the former the relation of subject and object is determined wholly by position, while in the latter there is in most cases a distinct form for each. That there is a tendency, especially in the speech of the uneducated, to disregard this distinction in the pronoun is clearly shown by such idioms as "Who are you talking to?" "between you and I." The solecisms, "you was," "they was," indicate a similar tendency in the verb.

Turning now to the foreign element in the vocabulary of Middle and Modern English, we should take care to distinguish between the Nor-



man French words introduced during the former, and the Parisian or standard French words introduced during the latter, period. As Skeat truly states (*Principles of English Etymology*, part ii): "Hundreds of words of Anglo-French origin, owing to their early introduction into the language, and the thoroughness with which they have been incorporated in it, have quite as strong a claim to our attention, and are found in practice to be quite as useful in their way as are those of truly native origin." (See NORMAN-FRENCH.) The presence of French is very noticeable in the poetry of Chaucer and Gower; but there is no ground for the statement that these writers corrupted the language by a large admixture of novel French words.

We may here notice the question which has often been asked: "Which of the early dialects spoken in England is the origin of the form now used?" We have seen that in the Anglo-Saxon period two were used for literary purposes—a Northern, or Anglian, and a Southern, or Saxon. In the period, however, succeeding the Norman Conquest, and more especially after 1250, we find not two, but three dialects: a Northern, a Midland, and a Southern. During the fourteenth century circumstances gave prominence to the Midland counties, in which arose the great universities, the rich monasteries, and many other religious foundations. One of its subdivisions, the East Midland, was the dialect in which Wiclif, Gower, and, above all, Chaucer wrote. It had then become the speech of the metropolis and had probably forced its way south of the Thames into Kent and Surrey. All these circumstances, combined with the fact that the Midland avoided the extremes of the Northern on the one hand and of the Southern on the other—that it was, in fact, a sort of compromise—gave to the East Midland a commanding position and made it the parent of the Modern English literary language. But while the East Midland came to be regarded as the standard English speech, the other dialects continued to exist and are in use at the present day; and a nucleus of new dialects, based upon several of the parent dialects, but gradually departing from them, has developed in the United States. (See AMERICANISMS.) Although all Anglo-Saxons write practically the same form of English, in their everyday speech they show differences of pronunciation and of vocabulary that are very marked. In English there is no standard of pronunciation such as is given in French by the French Academy.

During the Modern period of English the most decided change in the language has been in connection with the vocabulary. Ever since the beginning of this period the language has borrowed freely from many foreign sources. As a result of the influence of the Italian Renaissance at the beginning of the sixteenth century, many Italian words were introduced, and in spite of Ascham's dislike of them they increased rapidly. Contact with Spain on the Western Continent led to the borrowing of many Spanish words, and the commercial relations with Holland are responsible for the introduction of not a few Dutch words, especially maritime terms. In the seventeenth century political and literary connections with France helped to augment the French element, which has become extremely abundant, and the advances of science have created an immense number of classical terms, either borrowed or formed from the Latin and

Greek. Wherever Englishmen have gone they have absorbed into their language words describing local objects and ideas. The British conquest of India has brought in such words as *bangle*, *chintz*, *loot*, *mahout*; the war in South Africa has Anglicized some Dutch words, as *trek*, *outlander*; commercial relations with China have given Chinese words, as *china* and the names for the different kinds of tea. Of especial interest is the large class of Indian words, brought from North and South America, borrowed either directly or through the Spanish or Portuguese. Many of these come under the head of "Americanisms." During the four centuries of the Modern period the English vocabulary has gradually assumed the composite character which is one of its most striking features. All the Germanic languages, indeed, show a marked tendency to assimilate foreign words. The only point of inferiority that the modern English vocabulary shows as compared with the vocabulary of the oldest period is in the power to form self-explaining compounds, in which Anglo-Saxon was as rich as modern German. This inferiority of modern English is not so great, however, as would appear, since many words that are really compounds are written as separate words, as *insurance company*, *life insurance*. Many writers have at different times deplored the cosmopolitan character of the English vocabulary and have urged the exclusive use of native words in all possible cases. This extreme purism, however, ignores entirely the value of a varied vocabulary for purposes of literary expression, without which the language of Shakespeare and Milton would lack much of its beauty and force. The wise man selects from this rich treasury of words those that best express his thoughts.

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ENGLISH LITERATURE. The literature produced by the English people, amid the varied course of their national development, and in the vernacular tongue, whether purely Teutonic, or the fusion of that element with the Norman-French, or the splendid and highly organized language, rich in its double inheritance, which modern times have raised to such a pitch of power, flexibility, and grace. It must be treated as substantially one under all these various aspects, though its beginnings are to its present maturity as the weakness of an infant to the rich endowment of a full-grown man. On the other hand, for convenience, if for no radical or logical distinction, the literature produced in practically the same language by daughter peoples across the seas will not come into this survey. Nor will the method of treatment followed here allow anything like a complete enumeration of the authors who have adorned one period or another; it is considered, for the present purpose, of far greater importance to show tendencies and trace the outline of gradual development. Upon this principle, consequently, not upon any attempt at appraisal of absolute values, will be based the proportion of space allotted to the writers for a discussion of whose work there is room. We need not consider here the songs of the British bards, whose race and language were driven into the outlying hill countries by the Teutonic invasion, and who, save in the one notable instance of their contribution to the Arthurian legend, gave practically nothing to the literature now under discussion. By the terms of our definition we are also dispensed from dwelling on the work produced in Latin, the common language of scholars, before and after the Norman Conquest.

The development of early English poetry on its external side was not unlike that of corresponding poetry elsewhere. It was the one intellectual amusement of a race of hardy fighters and hunters. They gathered in the long winter evenings about the fire, to listen to tales of the adventures which had come to other men like themselves. As on the Continent, there were two classes of singers—the *scōp*, the real poet (maker, French *trouvère*), who took the raw material of history or legend and shaped it into more or less artistic form; and the *gléoman*, who, like the Greek rhapsodist or the French *jongleur*, simply sang from place to place what he had learned from others. From these lays sprang the most important relic of the poetry of the pagan period, the epic of *Beowulf*, which, although the only extant manuscript is of the tenth century, goes back for its inspiration and its subject to the sixth, and is therefore continental in its origin. It is impressive in its movement and imagery and possesses the dignity, if not the fullness, of the epic. Three other fragments from this period are of considerable interest—*Widsith*, or the Wanderer, probably

the oldest of all; *Waldhere*; and *The Fight at Finnsburg*. The characteristic of this early verse is its sombre grimness, and its picture of a life of constant combat, either with savage human foes or with nature in its sterner aspects, overshadowed by the approach of inevitable destiny.

But this fierce and gloomy tone was modified by the introduction of the gentler spirit of Christianity from Rome and from Ireland. The poetry written under this new influence, whose remains cluster about the ill-defined personalities of Cædmon and Cynewulf, finds a reason for a more cheerful view of life in the replacing of Fate by an all-loving and merciful Father. For its subjects it turns now to the legends of the saints; though even in these, as in *Judith*, e.g., the old savage joy in "goodly fight" still comes out. A few short poems of a lyrical or lyric-dramatic nature are of still wider interest, as connecting the work of these early singers definitely with the far-away Tennyson and Shelley. The tenderness and grace of *The Lover's Message* and *The Wanderer* remind us to take account of an imponderable but real admixture of Celtic elements in the people from whom they proceeded.

Prose grew up under Alfred (848-900) after he had set up a bulwark against barbarian invasion. Like most early prose, it is written for practical purposes—to convey instruction either in the truths of religion or in the facts of history. He translated from Latin the treatise of Boethius, *On the Consolation of Philosophy*, one of the favorite philo-sophical works of the Middle Ages; the Venerable Bede's *Ecclesiastical History*, the best historical work that England had yet produced; the *History of the World*, by Orosius, then considered a standard authority; and the *Pastoral Care* of St. Gregory the Great. More important still is the expansion under his direction of the meagre records of the monasteries into a clear and connected narrative, the *Anglo-Saxon Chronicle*, which continued without a break for two generations after the Conquest. The name of Ælfric (c.950-1021) must be mentioned as that of a man who showed signs of a real literary spirit in the sermons, which are his principal work. But the narrow and somewhat monotonous feeling of the Anglo-Saxon race could not have continued to evolve into a really great literature without precisely such an admixture of other elements as was to follow the Conquest and the resultant fusion of the two nationalities.

While the process was going on, classical and theological learning made considerable progress. Monasteries were busy, and the English universities had begun to crystallize around their original small nucleus. Lanfranc (1005-89) and Anselm (1033-1109), Alexander of Hales (?-1245) and Duns Scotus (?1265-1308), attained eminence in speculative philosophy; but they wrote in Latin, as did the historians of the same period, of whom the chief were William of Malmesbury (1090-1143), Geoffrey of Monmouth (?1100-1154), Giraldus Cambrensis (?1146-1120), and Matthew of Paris (?1200-59). The English tongue was undergoing such serious grammatical and phonetic changes as to unfit it for a vehicle of literary expression. The first indication of a living English literature appears in Layamon's *Brut* just after 1200. Influenced by the mass of French romance, he essayed for the first time to give his own language something

of the same character, and his position in the development of the Arthurian legend is of no small importance. After he had shown the way, numbers of English romances appeared, mostly translated or adapted from the French, though one of the most charming, *Sir Gawayne and the Green Knight*, is of native workmanship.

Besides the necessary delay in the interfusion of the two languages, there was also a question for the poets to settle as to which of two widely different verse forms should prevail. Saxon poetry had been based upon alliteration and accent; with its varying length of line, it was loose and flexible in structure. The French verse, on the other hand, depended for its effect upon rhyme and upon uniform line length and was thus exact and measured. The latter finally prevailed, after a period of great confusion; alliteration, as a rule, was dropped, to be used later only as an occasional ornament by masters of effect like Swinburne; while accent could no longer wander at will when the French prosody kept watch over it.

By the time that the language and its literary forms had accomplished their union, the life of the people also had completed a similar process. It was no longer Saxon here and Norman there, but was beginning to stand out as a new, independent, and finely molded nationality. Fortunately a great poet was ready to seize and fix on a broad canvas the varying hues of this full and brilliant life. Characteristically Chaucer (1340-1400) began by going to school to the French *trouvères* and to the later allegorical school of which the epoch-making *Roman de la Rose* is the typical work; then he went to Italy, where the sun of the Renaissance, not yet risen in England, was already calling to life manifold forms of intellectual and artistic activity; Dante, Petrarch, and Boccaccio stimulated him to rival their own productions and taught him to venerate the great masters of the classical ages. But his French and Italian periods were only periods of apprenticeship. When he had learned his trade, he threw aside imitation and stood forth boldly as an English poet—a finished artist in technical niceties as well as a great creator, who gave the final touch to the various literary forms which he found in cultivation, and drew from his ripe knowledge of men and things the power to stir the springs both of laughter and of tears as no one had done before him.

Chaucer and Gower (1325-1408) represent life from the aristocratic point of view, the former writing as an easy-going courtier, who simply ignores social questions, while the latter is conscious of their insurgence and stands stoutly for the old order against all tentative reforms. The other great names of the fourteenth century speak for the people and to the people. Langland—from whom analytical criticism has taken a part of *Piers Plowman*, long attributed to him alone—is of them; as he lies on the fair green expanse of Malvern Hills in the calm May sunshine, his heart is full of the paradoxes, the injustice, the unhappiness of the time, and he reasons out, through successive continuations and recastings of his work, a panacea for the ills of his generation. This, like the work of Wiclif (c.1320-84), is in the main religious. In an age when so many things conspired to make the life of the common people hard—taxation by the government for the endless drain of the French wars, oppression by the land-

lords, pestilence, storm—men's minds turned inevitably to the consolation of a world where inequalities should be redressed and sorrows comforted. The vision shines more and more clearly upon Langland's sight the more he ponders: Piers Plowman rises from a simple, honest tiller of the soil until he takes on the very lineaments of the incarnate Conqueror of death and hell. His thought has in many aspects a peculiarly modern tone—it is Carlyle who will take it up and reecho it—but in the structure of his verse he clings to the old rough alliterative form of the native English poetry, which, while it no doubt made a more direct appeal to his popular audience at the moment, unfitted him to have an influence upon the development of later poetry, now definitely committed through Chaucer to the assimilation of French forms. Wiclif, though the movement which we connect with his name was a university movement, appealed in the same way directly to the masses. This is not the place to discuss the effect or the justice of his crusade against the ecclesiastical system of his time; but by his translation of the Bible into the tongue of the plain people, and by the tracts which he wrote in homely, vigorous English, he affected in no small degree the development of the language. His Bible, in the various stages of its revision, exemplifies the final crystallization of a really English style, which at the same time, by its wide currency, it did more than any other book to fix and render uniform.

From this period until the Renaissance had tardily begun its work in England, there was little creative or really significant work. Lydgate and Occleve and James I of Scotland (the source of whose education entitles us to include him among English poets) were content to catch the trick of Chaucer's style and to name him and Gower as their avowed masters. Prose, however, in this as in all literatures later in its development than verse, began to take shape which is worthy of more than a passing notice. Though the universal employment of Latin as the language of scholars discouraged attempts to write serious English prose, yet the appeal of Wiclif's pamphlets and Reginald Pecock's *Repressor of Overmuch Blaming of the Clergy* to a popular audience brought it into the controversies of the time; and in lighter literature the *Voiage and Travaile of Sir John Maundeville* showed what could be done with it. This lesson was learned by Sir Thomas Malory, a greater master of style than the anonymous translator of that marvelous traveler's tale. The rhythm of his prose is at once stately and beautiful, simple and natural; and his *Morte d'Arthur* is the happiest thing in the whole of English fifteenth-century literature. That book, which Caxton printed in 1485, is intrinsically of high literary quality and is memorable, too, for the place it holds in the history of English fiction and for its long and potent influence upon English poetry to Tennyson and beyond.

In that very year Henry VII came to the throne, and the country, so long distracted by internecine warfare, had rest and leisure to think of intellectual culture. At last the "new learning" crossed the Channel and found a home in England. Grocyn (?1446-1519) and Linacre (?1460-1524) and their fellows were busy with their Greek manuscripts. Erasmus, the greatest scholar of the time, came to England, and with Colet (c.1467-1519) and More (1478-1535) dis-

cussed the great problems of church and state in a temper of hopeful idealism. But More and Roger Ascham (1515-68) were under the spell of classical authority, and the latter actually apologizes for using the clumsy English tongue. They wrote for the cultivated classes; but at the same time a popular literature was growing up around the Reformation movement, typified in the racy, idiomatic English of Latimer's sermons. Its simple directness was partly the fruit of his acquaintance with Tyndale and Coverdale's vigorous and happy translation (1525-35) of the Scriptures, a monument of pure Anglo-Saxon speech scarcely tinged with Latinism. The English Prayer Book, which, like the Bible, has done much to mold the speech of later generations, was a compromise in language as in doctrines; one of the most characteristic features of its style is the frequent recurrence of pairs of synonyms—"acknowledge and confess," "dissemble nor cloke"—to appeal alike to the lovers of the sonorous Latin and to the plain, unlettered folk.

The time was at last ripe for England to show the results of long and patient study and assimilation of good models, both classical and Italian. A year before Elizabeth came to the throne, these results were put forth in the publication of *Tottel's Miscellany* (1557), a collection of songs and sonnets, many of them no doubt written much earlier and, according to the fashion of the time, circulated in manuscript until that date. The two chief contributors were Henry Howard, Earl of Surrey, who had closed a brilliant life on the block 10 years before, and Sir Thomas Wyatt, who, like Chaucer, had visited France and Italy on diplomatic missions. Their matter was not so significant as their manner; their great service was the enriching of English poetry by the importation of foreign forms to relieve the monotony into which it had fallen. To Surrey it owes its most powerful and characteristic form, blank verse, and to Wyatt the sonnet, adapted by his happy intuition to the form in which Shakespeare uses it. Yet although they and Sackville showed taste and judgment in the use of their chosen tools, there was as yet little promise of the glorious efflorescence that was to follow. Lyly's refined and elegant artificiality, which has given the language a new word, and Sidney's charming work, which rises at times to a dignity above that of the experiments of a highly cultivated amateur, are not enough to turn the scale.

Yet, before we pass on to consider the drama in this period (for its earlier history, see DRAMA; MYSTERY; MIRACLE PLAY; MORALITY), there is one name which must be set, in the non-dramatic literature of the time, in a position comparable only with Shakespeare's, and one work which more fully than any other in English sums up the manifold effects of the Renaissance. Let Spenser be, as Lamb called him, the poet's poet; grant that he will never take hold of the great popular mass, of whose common life he is so wholly careless; he is yet one of the immortals, and it is to a world beyond space and time that he introduces us in *The Faerie Queene* (1590-96). A Puritan by conviction, though fortunately a Puritan born before his party thought it necessary to war upon everything that was beautiful, he has a moral purpose in his writing, and an allegory lies in wait for us as we wander through his enchanted land. We may elude it, however, and merely note that

the moral seriousness which lies at the root of the poem differentiates Spenser entirely from his Italian model, Ariosto, to whom he owes so much in form. But his style is richer and more elaborate than his master's; he builds up, on the suggestion of the Italian *ottava rima*, the more complex and effective stanza which goes by his name. His childlike delight in the world of sense, which, with all the marvelous resources of his imagery and his music, he strives to make us share, is touched at times by that note of melancholy so common and so significant in the Renaissance writers who stop to think of the shortness and uncertainty of that human life on which they concentrate their highest powers. Among the other poets of the time, Chapman must have a word of commendation, if only for his great translation of Homer, in which, for the *Iliad*, he employed what is probably the most successful metre in English—the swinging “fourteener” of the old ballads.

The causes for the phenomenal, one may say unparalleled, outburst of great literature which distinguishes the age of Elizabeth are many and varied. It was not only that the sunlight of the Renaissance, whose rays had been long in reaching England, now shone in all its radiance there; nor that the invention of printing had made it possible to circulate books by the thousand and raised the gains of authors to a point where they tempted new men into the field; nor that the personality of the Queen, exalted by the hyperboles of poets, formed a focus for their enthusiasm, while her gracious patronage of every art encouraged them to do their best. There was also the life and death struggle with Spain, which called out all that was highest and noblest in the hearts of patriotic Englishmen at the same time that domestic controversies sharpened their wits to do their best for the side they had espoused. There was the rise of the new middle class to increase the number of both authors and readers. And the discoveries of strange, half-fabulous lands beyond the seas seemed a fit pendant to the conquest of whole new provinces of the world; they spurred men's minds on to explore the regions of the knowable and the thinkable.

The drama, whose very nature appealed to that age of stir and vigorous action, was naturally the form that expressed its spirit best, aside from the fact that a century of printing had not yet made reading the daily habit of every man. And since the drama was to be the characteristic literary form of the period, it was most fortunate that it escaped the snares set for it by some of its earliest formal practitioners in England. With the enthusiasm of Renaissance scholars for the work of the ancients, they insisted that the English drama should be modeled strictly upon its Roman predecessor; Seneca was to be the standard of tragedy, and Terence, who had preserved a sort of charmed life all through the Dark Ages, of comedy. The academic school of the sixteenth century strove hard to enforce this model upon its fellows, aided by Sir Philip Sidney's vigorous blows in his *Defence of Poesie* (1579). The effort was not without its good results in the direction of imposing care for structure and checking too loose imagination; but that it failed was an inestimable advantage to the growth of the literature which is our pride. Marlowe and Shakespeare, the young Davids of the day, tried the armor of Saul before they went out to the

battle, then wisely laid it off. Across the Channel Malherbe and other literary dictators were able to enforce their canons, with the result that French classical tragedy, stately and finished as it is, has never been a living thing, able to thrill and dominate the nation, because it has always been alien from the nation's life.

Sackville and Norton, with their *Gorboduc* (1561), are enshrined in a special place of honor by historians of literary development; the first English tragedy is a noteworthy event. But to Marlowe (1564-93) belongs a much more significant mention. It is he who first showed the way to the construction of a true English drama, first exemplified a unity more potent than the artificial conventions of classicism—that which centres around the development of one mighty character and his deeds. It was he who, though the iambic pentameter was not new to English verse, is yet really the creator of the “mighty line” which became recognized as the regular medium for serious drama and in Milton's skillful hands became even mightier and more perfect. He, like his own Faustus, “sums up for us the Renaissance passion for life, sleepless in its search, and daring in its grasp after the infinite in power, in knowledge, and in pleasure,” and the career which ended so miserably in a tavern brawl, after less than 30 years, was yet full of splendid achievement.

The place of Shakespeare (1564-1616) in a survey of this kind must be in exact disproportion to his absolute greatness. Precisely because of the towering command of that greatness, because “he was not of an age, but for all time,” he has less to do with the general development of thought and expression than many a lesser man. It is not the mighty rock that rears its sturdy shoulders out of the torrent to which we look for indications of the direction and force of the current. In fact, though in a sense the crowning glory of English literature, he belongs not so much to it as to the whole world. He may of course be considered in part as a product of the conditions which affected the general literary growth; but when we stop to consider the other dramatists of his age we shall be struck by the difference more in kind than in degree between him and them; in the bold hyperbole with which Swinburne closes his sonnet, “All stars are angels, but the sun is God.”

The one of his contemporaries who comes nearest to him in rank, Ben Jonson (1573-1637), is also, it so happens, the one whose characteristics are the most instructive for the purposes of a philosophic contrast of tendencies. While the old theory of a personal envy of his master on Jonson's part is now discredited, the fact remains that he represents two points of view diametrically opposite to Shakespeare's. Almost alone in an age of far-going romanticism, he stood unflinchingly for the classical ideals in the drama—for the enforcement of the unities from which Shakespeare had escaped, as well as for wider and happier applications of what we call the classical tradition; for the calm, ordered sanity of that school in an age when the riot of imaginative license ran unchecked. While the struggle seemed fruitless at the time, his attitude was not without its results. The seed slumbered in the ground for a while; but in the end it sprang up and brought forth fruit in the fully developed classicism of Dryden and Pope. The other point of contrast touches the

never-ending controversy between realism and idealism. The former, for our purpose, may be taken to mean the kind of portraiture which is content to seize with fidelity the external characteristics of a man or a woman, while the latter designates the spirit of penetrating insight which goes far below the surface into the eternal verities of human nature—which sees men not only as they appear, but as they are, and perhaps even more as they may be. This was the spirit of Shakespeare, and it is largely because of his possession of this insight that he holds to this day his mastery over the world, while Jonson is read only by students of literature. In his own day Jonson was far more popular than the supreme dramatist; his faculty of hitting off to the life the little foibles and fashions of his generation, of painting (in his own phrase) “every man in his humor,” appealed to an audience who could recognize each detail as part of the daily life of their own circle; but when that generation had passed away, and new manners had come in with another, these old-fashioned humors roused no more than the evanescent interest with which to-day we regard the faded daguerreotypes of our grandfathers. Jonson’s most direct influence upon his age was found in the graceful lyrics which served as models for the cavalier poets, and in his domestication in England of the masque, which made *Comus* possible.

Of the other Elizabethan dramatists not so much need be said. The gradual evolution and sure and steady decline of the drama in England have been treated elsewhere; but a few memorable names, at which the world would have marveled longer had Shakespeare not been, must be chronicled. Dekker’s real if disorderly genius, Heywood’s simple and touching portraiture of domestic life, are worth a word. The “tragedy of blood” which, repellent as it is to modern taste, answered the cry of the time for intensity at any cost, was inaugurated by Kyd’s *Spanish Tragedy*; Marlowe and even Shakespeare touched it in passing; and two really fine poets, Middleton and Webster, signalized themselves in this style, the latter devoting his magnificent power of expression almost exclusively to these horrors. Beaumont and Fletcher can scarcely be named apart, though long and patient study has led modern critics to the conclusion that Beaumont contributed to their partnership the greater depth of thought and constructive power, while his older fellow furnished lyric grace, sentiment, and smooth-flowing diction. Massinger, a Puritan at heart, is at his best when he treats some theme of unworldly idealism. Ford, on the other hand, shows his decadent spirit by his morbid quest of the abnormal in character and situation. Shirley, an imitator in tragedy, is a precursor in the opposite style, writing in the exact manner of the light, graceful trifling of the Restoration comedy.

The greatest prose writer of the early seventeenth century is a man whose services to science, elsewhere dealt with, are even more commanding and universally recognized. Just as Bacon (1561–1626) saw the need of an entire reversal of the old scientific methods before modern science had realized the task before it, so he struck out for himself a way of writing English which anticipated the results of another century of thought on the matter. He had no confidence in the vulgar tongue and refused to intrust to it his scientific speculations; but when

he had occasion to use it, when his *Essays* began to grow under his hand from mere jottings in his notebook into their rounded and satisfying form, he set to work to shape an instrument that should be adequate to his purpose. Saturated as he was with Latin, and going to that language very much for his vocabulary, he saw that it was impossible to write one language by the rules of another, and developed an English kind of sentence, compact, brief, and manageable, in strong contrast to the long, rambling periods of his contemporaries. But prose was not long in developing into something more than a mere convenient instrument. Two writers who were boys at Bacon’s death carried it to a pitch of sublimity and impressiveness which, amid varied modern excellences, has scarcely been surpassed. Uneven, to be sure, sometimes almost too rich, Jeremy Taylor and Sir Thomas Browne at their best will always give delight.

They, far more typical of their age than Bacon, and another man even more typical than they, represent its overshadowing melancholy and its tendency to imaginative contemplation rather than to abstract thinking. Donne (1573–1631) is the best representative in these points, as in the suddenness with which he “passes from moods of earthly passion to moods of religious ecstasy.” As often happens, it was not his strength, but his weakness, that found imitators and created a school; his love of “conceits,” recondite and too subtle analogies and metaphors, which Marini and Gongora were at the same time making the fashion on the Continent, affected a number of the younger poets, of whom George Herbert, Crashaw, and Vaughan “the Silurist” were the most notable; but in him and in them depth and intensity of feeling atone for much that is merely fantastic. Two alternatives to the melancholy which Richard Burton (1577–1640) was at this time anatomizing with so much quaint learning were taken by different men; the cavalier poets, Lovelace, Carew, and Suckling, escaped it by their graceful absorption in the charms of real or imaginary mistresses; while the pastoral writers, Browne and Wither (with whom Herrick and Marvell may be classed, though religion meant at times much to both of them, and the latter went with Milton into politics), delight in the contemplation of nature and the sweet, unspoiled life of the beautiful English country, which touched Shakespeare in some of his ways at the beginning and end of his career—in the *Midsummer Night’s Dream* and in the *Tempest*. The same spirit breathes in Izaak Walton, and teaches him to write, little as he may have thought it, an undying classic.

The link between the Elizabethan age and that whose culmination is assigned to the reign of a later queen (Anne) is to be found in the work of Milton (1608–74). In his sonnets (except for the innovation of using the form for something else than love poetry), his elegies, and his masques, he is a true Elizabethan; in his thorough appropriation of the classics, in such technical points as the use of blank verse out of drama, and in many of the articles of his creed, he anticipates that which is to follow. Born eight years before the death of Shakespeare, and the heir of the great traditions of that glorious company, he is in one aspect, as Matthew Arnold called him, “the last of the immortals”; but still more truly he is a product of the new forces that were stirring in the Eng-



land of his youth. The change from the mood of the Renaissance to the sober earnestness of Puritanism may be summed up in Green's vivid words: "The daring which had turned England into a people of adventurers, the sense of inexhaustible resources, the buoyant freshness of youth, the intoxicating sense of beauty and joy which created Sidney and Marlowe and Drake, were passing away before the consciousness of evil and the craving to order man's life aright before God." The magnificent bursts of eloquence which diversify the long reaches of *Paradise Lost*, and the exalted and melody of his shorter poems, "epicisms," which Tennyson called "a touchstone of poetic taste," set noble models before his successors. Perhaps the greatest single lesson which he taught was the use of the cæsure in the iambic pentameter, which, in its variations according to the demands of a nice ear, makes all the difference between the best of his blank verse and prose chopped up into lengths of ten syllables. He did less for prose than for poetry; in fact, his prose is more rugged and harder to read than that of the earlier Bacon, and he himself confessed that in it he had the use of his left hand only. But what the accomplished scholar failed to do, a simple Bedfordshire tinker, nourished on the Bible and Foxe's *Book of Martyrs*, accomplished with triumphant ease. Bunyan (1628-88) little thought, as he followed the fortunes of Christian on his pilgrimage, that later critics would call his book one of the three great allegories of the world and discover in it at once a revival of the old French romance and an anticipation of the eighteenth-century novel.

The change which took place at the Restoration is often spoken of as if it had been a mere reversion to the temper of mind which prevailed before the destroying flood of Puritanism swept over the land. But this is a superficial view of it. The England of Charles II, whether in politics, in science, or in pure literature, was vastly different from that of Elizabeth. In the first flush of that age of splendid youth there seemed to be no limits to the powers of humanity. Men were not afraid to take, with Bacon, all knowledge to be their province, or to soar with Marlowe into empyrean heights. But the men of the Restoration, like burnt children, dreaded the fire of unrestrained enthusiasm which had kindled so devouring a conflagration. Moderation, the acceptance and study of actual conditions, the establishment of a quiet level of uniform conduct based strictly upon the dictates of common sense, became its ideal. Now for the first time in England criticism went hand in hand with creation. At an epoch when English literature was scarcely known across the Channel, when Bayle was defining Milton as "the famous apologist for the execution of Charles I," who "meddled in poetry, and several of his poems saw the light during his life or after his death," the returning Royalist exiles, on the other hand, brought with them from France the canons of a school of strictness there earlier established. Malherbe had risen to brandish the pedagogue's ferule over the young poets of that country; Corneille and Racine had framed their drama on the strictest classical rules. Dryden (1631-1700) followed them, both in the theoretical discussions of his *Essay on Dramatic Poesie* and in his practice: the classical school restored the unities, kept tragedy and comedy strictly separate, and usually employed rhymed couplets in

preference to blank verse. The tragedy of the Restoration, in which, besides Dryden himself, Otway must be mentioned for at least two imperishable plays, was largely a survival or an imitation. Comedy, however, has an importance of its own, if only for its exact reproduction of the tone and manners of the society of the time. It follows, not the romantic treatment of Shakespeare, but the realistic fidelity of Jonson and Shirley in the early years, or more consciously that which Molière taught its authors in France. Etherege and Wycherley, Congreve and Vanbrugh, are corrupt and cynical because such was the society in which they lived and for which they wrote. But we shall scarcely need to touch the drama again; from various causes it has practically ceased to have a living connection with literature, despite the brave attempts of no less poets than Tennyson and Browning and Swinburne to revive its ancient glories; there are clever comedians to-day, yet when we look for a comedy which will live in libraries, we must go back to *The School for Scandal*, *The Rival*, and *She Stoops to Conquer*—to the last quarter of the eighteenth century.

The tendency of the Restoration world to a strictly regulated uniformity, alluded to above, found expression in nondramatic poetry not only by an increasing preference, in subject, for the life of an organized and cultivated society, the life of the town, but by the almost universal adoption of a single form—the heroic couplet—which was to dominate English verse for more than a century. The form was not new; it had been used long before by Chaucer, as it was to be used again by Keats, but with a radical difference. In the hands, first of Edmund Waller (1606-87), then of Dryden and his eighteenth-century followers, each pair of lines as a rule contained one complete thought, limited and condensed by these narrow bounds. The influence of Dryden on prose was not dissimilar to that which he exercised on poetry. It was not, perhaps, so consciously exerted; prose had not even yet attained the dignity of a form worthy the careful attention of the artist. What he strove to do was to make it a fit vehicle for the conveyance of well-defined thought; and to this end he abandoned the long, rolling periods of the Elizabethan and Caroline prose writers—as in poetry, he "reduced the unit of treatment to manageable size"—and determined the structure of the modern sentence as it has ever since been preserved. Thus, in his own production in both kinds, as in his singularly influential and epoch-making criticism, Dryden bodied forth the spirit of his age and molded that which was to follow.

The eighteenth century was characteristically a period of unrest. Its intellectual ferment was fostered by skepticism, which invaded every domain. The concrete was engulfed by a flood of abstract speculations, and in industrial spheres the result was wholesome. Rationalism and deism were accompanied by an analytic study of man, almost exclusively, however, on his intellectual side. The spirit of man had suffered eclipse. All this we find in the poetry of the period. Pope (1688-1744), as the spokesman of the school, had declared the proper study of mankind to be man, and man was accordingly dissected. As a social unit, whenever so regarded, man is treated most flippantly, and the affections are mostly ignored. Indeed, it was a tenet of the philosophy then current that man was a most despicable thing, and yet it arrogated to

itself peculiar wisdom. Pope's adoption of this attitude was the sheerest affectation. From poetry in general the note of sincerity was missing, and the great god Pan was dead. In the evolution of literary ideals, however, ideals which find completest acceptance to-day, the eighteenth century is of the first importance and can boast some of the most delightful masters in both prose and verse. What these new ideals are may be indicated by a brief survey of these writers.

In philosophy, theology, history, and oratory the century takes high rank. Berkeley (1685-1753) attacked the sensation theory of Locke (1632-1704) and insisted on what has been termed a theological idealism. Hume brought admirable common sense and a strenuous skeptical spirit to bear on the theory and in his turn assailed Berkeley's thesis. Of other philosophical writers one may mention Hartley, Paley, Reid, Shaftesbury (of the *Characteristics*), and Dugald Stewart; and, though less important, Bolingbroke was more faithfully representative. Deism was the common target of the clergy. When Anthony Collins published his *Discourse on Freethinking* (1713), Bentley, Warburton, and Berkeley appeared in rebuttal. But the classic of this field is the *Analogy* (1736), in which Butler had the good sense to bear in mind that his work was not an absolute argument. The contrasts of the century cannot elsewhere be more manifest than in the rise of the Methodists. Where theory was impotent, practice availed. The pious life and strong personality of Wesley (1703-91) and the fervid preaching of Whitefield (1714-70) furnished the necessary corrective to the atheistic and deistic conception so widely prevailing. This countermovement was supported by a fine poetry of devotion, the work of the no less beautiful spirit, Charles Wesley, and by a multitude of hymns, many of them devotional rather than poetic, from the pious Watts.

To history Hume (1711-76) brought style and philosophy, but inadequate research, and his work has consequently suffered from the charge of inaccuracy. But though it is marred by a partisan spirit and is almost a Tory evangel, the historical sense is true, the method luminous, and the recognition of the life of the people as more important than statistics of dynasties introduces a new conception of historical composition which Macaulay and Green were not slow to appreciate. Smollett supplemented his fellow countryman's work, and Robertson wrote of Charles V and of America. It is Gibbon, however, who is the commanding figure in history. His stupendous plan was supported by equal resolution and fidelity. Learned, philosophic, stately, the *Decline and Fall of the Roman Empire* (1776-88) is a work which in its somewhat grandiose but still authoritative periods has not a little of the dignity of the epic. But perhaps the book of the greatest practical value, a legitimate response to the wide industrial awakening, is Adam Smith's *Wealth of Nations* (1776), the beginning of the science of political economy. In oratory the century was even more commanding. and Chatham, Fox, Pitt, Sheridan, and Burke are names which in this sphere are paramount, though Horace Walpole preferred Chesterfield, and Bolingbroke gained considerable prominence. Of Burke, indeed, it is difficult to determine whether he was greater as a writer or as an orator. He began as a man of letters, and such, despite

his political activity, he essentially remained. Though it is commonly believed that his speeches must have been better read than heard, Macaulay in his most energetic manner pictures the effect of his oratory in the Hastings trial as overpowering. Unhappily for his reputation as an amiable man, his vehemence of invective (as against the Duke of Bedford) was second only, if indeed second, to that of "Junius." The companion of the most cultured men and women of his time, he was perhaps the greatest of them all, and never more himself than when he befriended the starving poet Crabbe.

In the eighteenth century we find the beginning of the periodical essay, which enjoyed high favor as a literary form and became the vehicle of some of the best writing in the whole range of English prose. (See *ESSAY*.) In 1709 Steele established the *Tatler*, in which he began the publication of short articles on literary and social topics. Soon he had the hearty coöperation of his old schoolfellow, Addison, who was peculiarly fitted for such work. Together they founded the *Spectator* (1711), in which appeared the chivalrous Sir Roger de Coverley, who may dispute Robinson Crusoe's title to the position of the first notable character in English prose fiction. Steele's essays were marked by ease and naturalness and somewhat atoned for the vicious taste of the sentimental drama to which he unworthily lent his name. Addison brought to prose a grace and an ease which it had scarcely known except in Shakespeare; and when his *Campaign* and his *Cato* are forgotten, the elegant simplicity of his essays will still charm new generations. A wonderful contrast, in both person and manner, is that between these genial humorists and the moody dean of St. Patrick's. Swift must always be remembered as a man of great force of mind and character, set awry by disappointment and bodily suffering. Conscious of high endowments, he was inspired by his sense of injustice and neglect to write *Gulliver's Travels* (1726), the classic of injured merit and of angry revolt against the shallow discriminations of society and government. His morbid spirit became terrible in the intensity of its hate for mankind. With Swift the style was the man—fearless, aggressive, sturdy. Yet he made warm friends and inspired a singular devotion in two women; beneath that rugged exterior there must have been a naturally tender heart, which would have leaped to meet a brotherly recognition.

For homely simplicity and directness, the nervous style of Defoe at his best has rarely been excelled. His numerous pamphlets and his verse are practically unknown to the general reader; but *Robinson Crusoe* (1719), the classic of the race of boys, is a masterpiece of adventure. His other stories, little read, differ from the modern novel in the absence of a plot, but resemble a special phase of it in being written with a purpose—in his case to enforce the morality of the middle class, to which he belonged and for which he wrote. Sterne's chief work, *Tristram Shandy*, is as far as Defoe's tales from possessing the coherence and the regulated progress of events which mark the modern novel; it is capricious and uneven, while, unlike Defoe, Sterne deliberately rebels against the moral standards which Addison, e.g., had enforced on his generation. But his humor, which has caused him to be classed now with Rabelais, now with Cervantes, his finished senti-

mentalism, as distinguished from genuine sentiment, and his power of creating characters endowed with an absolute reality—all these unite to give him a conspicuous and very special place.

The novel proper began with Richardson, though it is probable that he was unconscious of creating a new literary *genre*, which was destined to overshadow all others in multiplicity and popularity. His method seems to have meant to him a sort of expansion of the drama; he calls *Clarissa Harlowe* (1747-48) "a dramatic narrative." There is in him much of the tedious prolixity of the French romances; but he possessed the faculty of interesting the reader, partly by a quality which has lost its appeal for us, but to which Lady Mary Wortley Montagu, e.g., bears abundant witness—his realistic fidelity to the types of character and the manners of his own time. But even had Richardson no merits of his own, we should still be grateful to him for provoking Fielding to enter upon the writing of fiction. Fielding's variety of experience, his apprenticeship in the drama and in periodical literature, his accurate observation, united with his native capacity in all kinds of literary endeavor, admirably fitted him for the . . . scope of the novel. Great in plot, . . . power to marshal all details and to conduct them masterfully to the dénouement. He is another of the great humorists, and he is still modern. Before *Tom Jones* (1749) appeared, a new writer of fiction had published *Roderick Random* (1748). Smollett had much the same reason for cynicism as Swift, he fancied, and the accent of his work is pessimistic. He is said to have had greater influence on the development of fiction than any other writer of his time. His work, however, smacks of the far-away period of Cervantes and Le Sage and does not enthrall like that of Fielding. Goldsmith's charming idyllic story of *The Vicar of Wakefield* appeared in 1766 and, winning Goethe at once, has since won the world by its "happy reinforcement of the theme of domestic bliss and tranquillity." Sharply contrasted with its grateful simplicity is Johnson's *Rasselas* (1759), the style of which is characteristically ponderous. It is interesting at least as the sole attempt of the great autocrat in a form for which his aptitude was anything but conspicuous. Here also belong Miss Burney's *Evelina* and *Cecilia* (1778 and 1782), both of which are said to have been as eagerly received as Scott's work was subsequently to be. Assuredly it would be a tribute to any author to have Johnson, Burke, and Reynolds become so far absorbed that they were unwilling to put the book down, the two latter spending the whole night on it. Here, too, should be mentioned Godwin, for his *Caleb Williams*, as well as for his abstract philosophic work; Horace Walpole, for his *Castle of Otranto* (1764) no less than for his *Anecdotes of Painting, Memoirs*, and supremely fascinating letters; Lewis, for his *Monk* (1795); Mrs. Inchbald, for her *Simple Story* (1791); and Mrs. Radcliffe, for her *Mysteries of Udolpho* (1794). The first of all this company in sheer power is easily Henry Fielding, while for grace as inimitable as it is distinctive Goldsmith leads; Miss Burney excelled in the depiction of domestic character; with Walpole began the novel of mystery; from Lewis and Mrs. Radcliffe we receive those "tales of terror" which were afterward wrought out

and with Godwin the "novel with a purpose" enters upon its long career. It should be noted that here woman first appears conspicuously in English literature; and not alone in fiction, as becomes evident when we consider Lady Mary Wortley Montagu (1689-1762) and Mary Wollstonecraft (1759-97).

Great as was the eighteenth century in prose, its claims upon us are yet greater in the field of poetry. The two dominant figures of the period were, indeed, Pope and Johnson; but their rigid and sometimes absurd classicism was in their own day beginning to be superseded by the romantic revival, whose culmination constitutes the brightest chapter in our literary history after the Elizabethans. For their contemporaries they were the overshadowing poets. In Dr. Johnson (1709-84) we find a man who by virtue of his vigorous personality, even more than Dryden and Pope, stood out from his age. What he lacked in intrinsic literary preëminence he supplied by a tyrannous dictatorship. His impetuous prefatory "Sir!" was sufficient to intimidate, if not to convince, and his reign as literary lawgiver ended only with his life. For all his versatility, he is now largely a literary memory and survives rather as a personality. His *Lives of the Poets* discovers gleams of genuine critical insight, but, on account of ingrained prejudice, his judgments are untrustworthy. His "Vanity of Human Wishes" and his "London" are good imitations of the Popian satire, but they must suffer by comparison. The play *Irene* is known to few. The *Rambler* and the *Idler* are heavy successors of the periodical essay made so popular by Steele and Addison. But the preface to his *Shakespeare* is deservedly famous for its uncommon good sense, and the *Dictionary* is a monument of lazy industry, not without absurd eccentricities. The man, however, who could inspire perhaps the best biography ever written, merits, aside from literary considerations, all the immortality he enjoys. Pope it is, however, who inevitably assumes the largest claim on our attention when this century is thought of. He is the representative voice, his the characteristic manner. By some denied the title of poet at all, he was by a few classed with Shakespeare as a twin glory; and, for obvious reasons, he is, after the great dramatist, the most quotable of English poets. To apothegmatic thought he joined admirable conciseness of phrase. We must not confound his own viewpoint with that of a later day. If we take exception to his poetical ideals, we must allow that in his own time he was consummate and unapproachable in their execution. It is, however, the consensus of opinion that he was a clever versifier and epigrammatist rather than a poet in anything like the highest sense of the term. His mental alertness is always seconded by mechanical skill. But, though more perfect in polish, his couplets are far from equal in beauty and variety to Chaucer's and Goldsmith's, and much below Dryden's and Browning's in strength. Like them, he could not snatch a grace beyond the reach of art. He polished until he polished all spontaneity out of his verse. It affects us as machine-made—the work of an artisan rather than of an artist. No wonder the fine poetic soul of Keats recoiled from it as resembling the rocking of a hobby-horse. From these considerations one is prepared to admit that Pope

not equivalent to damning with faint praise. It is equally true that he is peerless in the mock-heroic. Unquestionably *The Rape of the Lock* is a masterpiece of its kind, but it is too characteristic to warrant the praise sometimes bestowed. He was by temperament finely constituted for satire, and though some of his friendships were warm, *The Dunciad* reveals him alike at his best and at his worst. The "Essay on Criticism," the "Essay on Man," and the various "epistles" discover the clever man of letters with a remarkable facility for rhyming the literary canons and philosophy current in his day. For any intellectual force which the ideas themselves may possess he can present no legitimate claim—he is simply the adapter, though his alone is the form. He was for the most part as devoid of emotion as of imagination but there is one poem in which a real human interest predominates. The least distinctive, it will appear to many his best. "Eloisa to Abelard" is a soliloquy, which, while inevitably artificial, yet appeals to the heart and brings the tragic lives of the ill-fated pair with a degree of vividness before us. Perhaps more than anything else this poem, so little heard of, reveals to us the potential maker. If Byron's somewhat extravagant admiration should be shared by others, or if the present common acceptance should hold, it would seem that it must be by virtue of historical criticism and the personal estimate rather than because of any absolute poetic preëminence. But let the critics do and say what they will, the little man whose indomitable will sustained the life which was one long disease, and who under difficulties that would have appalled a weaker spirit wrought stoutly on, will never cease to have a following.

The crowning glory of the century, however, was its least characteristic poetry. Now returns that fresh breath of field and woodland, absent since Milton, but never lacking since; and this time the love of nature for its own sake. It is conspicuous in Gray, Thomson, Cowper, Goldsmith, Collins, and Burns; culminates in Wordsworth; and pervades, and may well-nigh be called the touchstone of, the most of nineteenth-century verse. Gray (1716-71) had the scholarship befitting his fastidious classical taste, and yet his "Elegy" breathes the very spirit of the time in its genial recognition of common brotherhood and its catholic appreciation of virtue wherever found. It was a new voice, and sweet are its accents still. By this utterance the man is best known, though his other poetical work is memorable, and the *Letters* are almost incomparable. The romantic spirit was in the air and became rapidly infectious, but the traditions of a staid classicism obstinately persisted and incongruously mingled with the more unrestrained newcomer, notably in Thomson.

It is this new ideal—romanticism—which, after the novel, gives the eighteenth century its strongest claim to distinction, so far as tendencies are concerned, and the tracing of the movement from its beginnings is no less instructive than alluring. Cardinal dates must always mark the tremendous significance of Percy's *Reliques* (1765). Of perhaps less importance, but similar in aim and spirit, Ossian (1760-63) exerted great influence on the time, now fairly alive with new things. Whatever the merits of the controversy about its value or

authorship, we are surely indebted to Macpherson for a work quite unique. The marvelous boy Chatterton is one of the many evidences of the prodigality of this renaissance. Like poor Swift, dying atop, the melancholy Cowper and the sensitive Collins had yet to sing—the one in meditative strains, the other in madly impetuous lyrics. Thomson's *Seasons* had great popularity in Pope's own day and was commended by the man who fancied he could invent nature, so completely had it been forgotten. The "Pastorals" is the dismal result. But Thomson's highest achievement is the "Castle of Indolence" (1748), which might well be mistaken for the witchery of Spenser himself. For Goldsmith the world cherishes unmixed affection. He is dear as poet, critic, dramatist, novelist; and if his history and science will not bear closest scrutiny, the charm of the style is amply sufficient to redeem errors in matters of fact. And for all he was, in a worldly sense, impractical, he brought so rich a fund of common sense to poetry and the drama that he demolished the sentimental stage and invested descriptive poetry with a charm as grateful as it is rare.

For historical if not for better reasons, Beattie should be mentioned for his *Minstrel*, Shenstone for his *Schoolmistress*, Akenside for his *Pleasures of the Imagination*, Young for his *Night Thoughts*, Churchill for his *Rosciad* and other satirical work, Blair for his *Grave*, Dyer for his *Grongar Hill*, Gay for his *Beggar's Opera*, Ramsay for his *Gentle Shepherd*, and Parnell for his *Hermit*. The mystical Blake (1757-1827) had a nature sublimely artistic, and his *Songs of Innocence* and *Songs of Experience* are alike valued for imaginative poetry and for symbolistic art. In no indefinite sense he is akin to Dante Gabriel Rossetti. Crabbe (1754-1832) is noteworthy for his merciless fidelity in depicting real life in his *Village* and his *Tales of the County*, and Bowles for his sonnets, which Coleridge greatly admired. But, alien as he is from its spirit, the most consummate flower of the century, the most spontaneous genius of its poetry, is Robert Burns (1759-96). If ever poet was inspired by something beyond himself to sing his inner raptures, it was this Scottish peasant. Head, heart, and eye alert, he sang to a rapt world such strains as are seldom heard. For fervor, genuine manhood, absolute sincerity, emotional power, and essential poetic beauty he has few peers. Education would have spoiled him; he loses his sureness of touch when he essays the classical English, but he goes straight to the heart with the winsome grace of his Doric Scotch. That he should have arisen in an age which had been given over to artifice under the delusion that it was art is not amazing, for he was a lyric poet born. He was democratic in a time when to be so was to be solitary, radically true when cant and hypocrisy were rampant, and his satire is the bitterest because his heart was naturally so gentle and loving. He had a sense of worth, a sanity of thought, a largeness of vision which made him resolute and unfearing alike in championing the true and in lashing the false.

It is not to undervalue the work of such men as Burns and Gray that one singles out the names of Wordsworth and Coleridge as those of the poets who really determined once for all the character of nineteenth-century poetry,

gave it back its freedom, and widened its field of vision. The year 1798, which witnessed the publication of the little anonymous volume of *Lyrical Ballads*, which included poems of both Wordsworth and Coleridge, is, then, the epoch-making date from which these great changes are to be reckoned. The change was vast, both in matter and in manner. In style the young and unknown authors boldly contended for the right to use the language of everyday life in place of the conventional words from which a century of passing from hand to hand had obliterated every characteristic feature. In subject they struck boldly away from the manners of the town, or of townsmen, as the Arcadian shepherds, which had been the staple of the eighteenth-century poets. When Pope wrote

"The proper study of mankind is man,"

he meant man as displayed in the elegant circles of London or as conceived in the speculations of deistic philosophers. Wordsworth studied man in a vastly broader sense and found the cottager or the wagoner as much a man at least as the beau. Like most far-reaching reforms, this went at times too far; simplicity, which, rightly understood, is a canon of the greatest art, became childish in his hands at times and lent a handle to the mocking parody of the Smith brothers in their clever *Rejected Addresses*. But he had struck the right note—a note which is so familiar to us from the whole drift of nineteenth-century thought that we scarcely discern how valiant a departure from the mode it was.

Coleridge, whether or not he was conscious of it himself, stands out clearly to us a century later as the necessary complement of his associate. While Wordsworth showed the beauty, the depth, that could be found in the most commonplace of lives, Coleridge rather brought home to a nation that had forgotten the daring flights of the Elizabethan age the reality of the invisible world and paved the way for the Pre-Raphaelite movement of half a century later. His influence on his century, however, was exercised less through the medium of his poetry than of his prose, through his own pregnant thought on deep questions of philosophy, of religion, and of politics, and by the current of German tendencies which he set flowing amid the still waters of English life, powerfully seconded by Carlyle.

If Wordsworth influenced the thought of his successors in poetry for the whole century that has followed, their form was more powerfully affected by the man who died with so many dreams unfulfilled that he spoke mournfully of himself as "one whose name was writ in water"—John Keats (1795–1821). Standing utterly aloof from the fierce controversies of his time, caring less than nothing for the questions of emancipation which were so vital to his friends, absorbed in the practice of his art, Keats showed later poets how to seek out "the right word," the word which should express poignantly their inmost thought, no longer content with epithets which had been handed down by a long line of polite predecessors; in Lowell's happy phrase, he "rediscovered the word." He wonders that lay enchanted in

exacerbated by what he felt to be the injustice of society to himself, found voice in passionate protest against existing institutions, against anything that could cramp or fetter the individual in his search for the satisfaction of his desires. The thing became epidemic; the figure of the reckless young lord, magnified to heroic proportions, Ajax defying the lightning, was the ideal of hundreds of other high-spirited young men, not only in England, but on the Continent; and the rolling Byronic collar became the badge of a generous independence of thought. The fact that Byron voiced the spirit of his generation with so much real force and fire is at once an explanation of his immense and immediate popularity. He will always be the poet of hot-headed youth; but it is possible to see now that he was carried by the rush of the moment into a place far higher than he can hope permanently to hold. Those who doubt this may be sent to the criterion proposed by a living judge of rare equipment; it is simply necessary to read Byron immediately after a course of one of the poets whose place in the first rank is indisputable—after Shakespeare, after Spenser, after Shelley—in order to rise from the reading with the conviction that, undeniably great as were his gifts, he is not of their company.

The name of Shelley (1792–1822), just mentioned, and always to be mentioned with reverence for the loftiness of his flight into the empyrean, for the splendid attainment of his music, for the moving appeal of his lyrical cry, yet must have less space than that of Keats, e.g., in a survey like this of tendencies and growths rather than of men, since his genius was less seminal, less formative. With a purer, less selfish enthusiasm than Byron's for the rights of humanity, he too sang the paean of that universal freedom which seemed to be dawning on the world, and died before he could be convinced, with Wordsworth and Southey, that he had mistaken the glare of a sunrise for the sunrise. An outcome of the excitement of this period was the revival of a spirit of patriotism and nationality, akin to that which had been so potent in the Elizabethan days, but which the calm, cosmopolitan culture of the eighteenth century had rather lulled to sleep. It is represented by the stirring war-songs of Thomas Campbell (1777–1844), a convert from classicism to romanticism; by the poetry as well as by the novels of Scott (1771–1832); and by the Irish lyrics of Thomas Moore, far more genuine and worthy of preservation than the artificial decorativeness of his Oriental tales.

But the most significant change which took place at the outset of the nineteenth century was the linking of that age to the forgotten inheritance of England's past. The eighteenth century had been practical, self-centred, self-sufficient; if it sought an example at all outside of itself, its eyes were turned toward Greece and Rome. The Middle Ages were to it a period of barbarism, unworthy the attention of serious men. Thus Addison went to Rimini, and, though he knew that the Malatesta had been lords there of old, while he notes a Roman inscription "still legible, though wrongly transcribed by Gruter," and discusses the learned Frabetti's ingenious conjecture on Trajan's pillar, had not a word to say of the story of Francesca, which to modern minds is the chief in-

The revolt from the conventionalities of the preceding age showed itself in another and a more startling way. The spirit of Byron (1788–1824), naturally restless and impetuous, and

terest of the place. The reversion to a realizing sense of continuity in English history and letters is the work mainly of two men—Scott in life and Charles Lamb (1775–1834) in literature. The work of the former becomes of great significance under this aspect; it was he who, by his rendering mediæval life and “the spacious times of great Elizabeth” vivid and actual, made it possible for Carlyle and Ruskin to analyze modern life by the method of contrast; it is not too much to say that he paved the way for that important and far-reaching movement by which the Oxford Tractarians changed the religious attitude of England and turned men’s faces toward Catholic antiquity. His other great achievement was his triumphant mastery of a kind of literature which had been unsuccessfully attempted for two thousand years—the historical novel. Lamb’s work was the revival of the older English literature, neglected since the Restoration. The attitude which made it possible for Pepys to call the *Midsummer Night’s Dream* “the most insipid, ridiculous play that ever I saw in my life,” which allowed Dryden to win applause by a frigid recasting of *The Tempest*, and which culminated in the honest declaration of George III that he found most of Shakespeare “very poor stuff,” was reversed by Lamb’s discerning enthusiasm for the glories of Elizabethan literature, which came upon his generation with all the freshness of a new discovery. In this work he was ably assisted by Hazlitt and Leigh Hunt, of whom the former had a critical faculty even surer and wider, if not more delicate, than Lamb’s own. The influence of these men on the prose style of their successors, in the direction of flexibility and grace, was exceedingly valuable. Stevenson especially, of later essayists, owes a great debt to one of them, which he frankly acknowledged with his “though we are mighty fine fellows nowadays, we cannot write like Hazlitt.”

Another kind of prose, excellent in its way, was written about the same time by De Quincey (1785–1859) and Landor (1775–1864). It had less consequence, though Ruskin exemplified it in a style which, at its best, lacked only the care forbidden by the multiplicity of his other interests to set it in the very highest place. This was the ornate and highly colored prose which in the earlier English we associate with Jeremy Taylor and Sir Thomas Browne—full of “purple patches” and sonorous Latinisms, and with a majesty and a melody that make the organ its nearest type in music. Living all through the heyday of the romantic triumph, Landor remained (in his poetry, at times of rare excellence, even more obviously than in his prose) calmly classical, “striving with none, for none was worth his strife,” handing down a tradition which was worthily continued by Matthew Arnold, and honored in his old age by a singer in many ways so far from the classical temper as Swinburne.

The great reviews and magazines which came into existence early in the nineteenth century had an important effect upon its literary progress. The *Edinburgh Review* was founded in 1802 to uphold the principles of the Whig party, by Sydney Smith, Brougham, and Jeffrey, and the last named soon became its editor. Its unsparing personal criticisms of contemporary authors caused an immense sensation and evoked Byron’s scathing retort entitled *English Bards*

and *Scotch Reviewers*. The *Quarterly Review* was established in 1809 as the Tory organ; the truculent Gifford was its first editor, and Southey, Scott, and Lamb among its contributors. Somewhat later came *Blackwood’s Magazine*, for which Wilson wrote his *Noctes Ambrosianæ* and Lockhart his trenchant criticisms. There was also the *London Magazine*, to which Lamb contributed his *Essays of Elia* and De Quincey his *Confessions of an English Opium-Eater*, and for which Carlyle, Hazlitt, and Leigh Hunt also wrote. All these great periodicals exerted a powerful influence upon literature, especially in the development of the art of criticism, which has become almost an independent branch of letters.

The first force of the philanthropic outburst, the realization of the brotherhood of man, which Wordsworth and Shelley in their different ways had expressed, had partly spent itself, as Europe settled down after the revolutionary period of *Sturm und Drang* to a reaction in favor of orderly and settled life, comparable to that which was noted above as following the violent struggles of the Reformation and the rebellion. One author of the second quarter of the century typifies better than any other the mood of placid self-satisfaction with things as they were—Macaulay (1800–59). His spirit of cheerful optimism, his calm assurance that the existing British constitution was the most wonderful product of the human intellect, and everything for the best in an admirably ordered world, represents fully the characteristic temper of the England of his younger days. Out of this complacency the nation had to be roused by a rude shock. The voice as of one crying in the wilderness, the trumpet tones which startled this complacent England, were those of Thomas Carlyle (1795–1881). It is difficult to realize how electrical was the shock of his sudden onslaught, how the impetuous torrent of this rough eloquence carried away all the thoughtful younger men of the day. As Byron a generation earlier had made a picturesque melancholy the fashion, so Carlyle set his contemporaries to studying social questions, insisting that they should realize the crying need for many and sweeping reforms in the state of society which they had fancied so perfect. With the acceptance of his gospel begins a new epoch in English letters. They were for the first time closely and intimately connected with the life and the progress of the whole race. Addison had indeed written with a moral purpose, thinking to soften and refine the manners of London society; but Carlyle went much further than this and set in motion springs which have never ceased to act. If we wish to bring home to ourselves how far we have traveled under this powerful impulse, we have only to try to imagine Sir Walter Scott reading, one need not go so far as to say the novels of Mrs. Humphry Ward, but even those of George Eliot. The criticisms of Carlyle’s style, which caught the ear for the moment and have tempted many a young writer into unhappy efforts at imitation, have passed away; but his spirit lived after him in the earnest crusade against immemorial abuses which enlisted the best energies of widely differing minds. England was at last awake. On every side were the stirrings of new life—in politics with the Reform Bill and the Anti-Corn-Law League, and the teachings of the Owenites, for the first time called Socialism; among religious teachers with the Broad Church movement of Maurice (1805–



72) and Kingsley (1819-75), and the Oxford Tractarian school, both of them full of social suggestion; with the bold searching into the depths of the human heart by Tennyson and Browning. Thackeray cried out against shams in the very spirit of *Sartor Resartus*, and Ruskin's fiery heart could never rest while there was a wrong to redress, a man or a woman to raise to a higher plane of thinking and living.

The names of Tennyson (1809-92) and Browning (1812-89), though both these poets lived until the agitations of the thirties seemed ancient history, are connected with the century as well as by their work with this period, their first books having appeared at the opening of this stirring decade. Both continued for over half a century, in widely differing ways, to express or to stimulate and inspire the thought of thousands of readers—of more thousands than the words of any English poet had ever reached before. Tennyson's audience was by far the larger, if perhaps less fit; he made less appeal to intellectual alertness, and the average reader, who turned away puzzled from most of Browning, felt at home in the easy and at times commonplace sentiment of the Laureate. The work of *In Memoriam* was perhaps the most valuable that its author did for the thought of his age; it was the courageous facing of the new discoveries and theories in science, which seemed likely to make an end of belief in a spiritual world, and the showing that this world, and poetry which knows its ways so well, were not to perish before the Darwinian hypothesis. But in form, in technical achievement, in the flawless finish of his style through all the kinds of poetry which he attempted, he has had few equals. There is scarcely one of his great predecessors whose peculiar excellence he has not caught, fusing them all into a style unmistakably his own. Browning had far less perfection of finish, but much more robustness of nature and of thought. Tennyson believes in and preaches constantly an overruling law which shall ultimately bring order out of chaos; his brother, not rival, poet (there was no room for jealous emulation in either of their souls), since his chief interest was in the life of strong single souls, found satisfaction for his undaunted optimism in the fact that it was possible for such souls to make their life by courage and truth. His works have been well called "a permanent storehouse of energy for the race, a storehouse to which for a long time to come it will in certain moods always return." His wife, Elizabeth Barrett Browning, though she was long far more popular than he, is chiefly interesting from the noble and ardent way in which she throws her whole soul into the cause of the oppressed, in England or in Italy. Once at least, in her wonderful *Sonnets from the Portuguese*, she rose by her passionate love for her husband to really great heights of poetry. A greater poet, however, probably the most notable among the women singers of the century was Christina Rossetti, the sister of the Pre-Raphaelite leader.

A link between the prose fiction of the eighteenth and that of the nineteenth century is not found in Miss Austen (1775-1817), sure in dramatic instinct, unimpeachable in the construction of her plots, and unerring in her observation of the external accompaniments of character as she is; she is a realist, presenting "humors" (in Ben Jonson's sense) and going little below the surface. The connecting link is rather a woman

less known and less considered, Maria Edgeworth (1767-1849), who suggested the right use of local color to Scott—and, be it said by the way, to the great Russian, Turgenev, his studies of peasant life—and who saw that an effort at accurate portrayal of the seen need not hinder a vivifying perception of the unseen. After Scott the novel greatly widened its scope, to deal, as did the drama under Elizabeth, with all the problems which human life has to face. Three writers who made their fame in this department express the temper and depict the people of the middle of the century—Thackeray (1811-63), Dickens (1812-70), and George Eliot (1819-80). Their absorption in the social problems which we have seen coming to the front made them realists, and with succeeding generations they have suffered from this attitude. Dickens especially, whom 20 or 30 years ago it was heresy to decry, is now far less read, for the reason given above in the treatment of the Elizabethan realists: his questions are no longer actual—we are not moved by the delays of Chancery or by ancient abuses in prison discipline—and his people, living as they were to his contemporaries, are to us no more actual than the quaint figures of old sporting prints. Thackeray's problems have more of the permanent about them, and while his leisurely, discursive manner has become old-fashioned, and his inability to construct a consistent plot is apparent, he must always hold a very high place in English fiction. George Eliot is not only remarkable for having, as a woman, been among the first to take her place by the side of the men in strenuous discussion of public questions; more than either of the novelists just named, she saw life steadily and saw it whole; and far more than they, she reflects the questioning, uneasy temper of her generation in regard to the great problems of the soul. Not alone in her novels, but in the poetry of Arnold (1822-88) and Clough (1819-61) does this same spirit find expression.

Arnold, like Aaron of old, stands between the dead and the living—between the old faiths, the old attitude towards life, so largely outworn and discarded, and the new temper of hopefulness in the development of the race and its ability to face new problems; but, unlike Aaron, he holds no smoking censer of propitiation to slay the plague which he feels to be devouring his generation. In thought he is thus eminently characteristic of his time—the period of transition which covers the middle of the century. From the fact that his poetry is tinged throughout with half-despairing melancholy, it is rarely appreciated at its full value until the illusions of youth have passed away; like his master, Wordsworth, he is the poet of middle age. But in his prose, even more classical in its quality than his verse, he has appealed to a wider class and done a more enduring work. He is the supreme critic of the early Victorian period, not only in the literature, but in life as well. He turned from the deep problems in which he saw no hope, and devoted himself to preaching the lower but still valuable gospel of culture. Carlyle and he represent perfectly Heine's antithesis between the Hebraic and the Hellenic elements in human nature—the one holding up an ideal of stern, uncompromising devotion to duty, and promising no reward but the approval of the conscience; the other inculcating the broad, free, mobile open-mindedness of the Greeks—the apostle, in the phrase which he borrowed from

Swift and made his own, of "sweetness and light."

Opposed to Arnold's urbanity, to the temper which has caused him to be called "a spiritual man of the world," stands in sharp contrast the attitude of two great contemporary authors, Ruskin (1819-1900) and Newman (1801-90). For our purpose the dictatorship so long held in matters of art by the one, as well as the notable and epoch-making ecclesiastical career of the other, must be neglected; but we are bound to take account of their general influence upon the thought and the writing of their day. They were alike in more than one external feature of their magnificent prose; no nineteenth-century styles, e.g., show more abundantly and more happily the effect of a lifelong saturation in the majestic and beneficent English of the Authorized Version of the Bible. But they have a deeper kinship in their equal insistence upon the reality of the unseen, the spiritual world. Whether he wrote of art or of political economy, this lay at the very root of Ruskin's firmest beliefs; and thus he was naturally forced to look backward rather than forward—away from the future with its increasing zeal for material progress, to the past of the Middle Ages with its universal and vivid sense of the reality of the invisible and the eternal. Newman's abhorrence of the intellectual anarchy of his day drove him in the same direction and brought him, after much tossing on troubled seas, "to the haven where he would be." Both of them are thus once more opposed to Arnold; while the temper of his mind was purely classical, they came in different ways to share the spirit of the romantic movement in its revulsion from a prosaic and sordid present.

The same attitude of mind was even more definitely exemplified at the same time by the rise of a school which powerfully affected both art and poetry, though it is only with the latter that we are here concerned. The Pre-Raphaelite Brotherhood had not, at least in poetry, discovered any new truths; their cry for a return to nature, their appeal to "the spirit of wonder and mystery in human life," had both been articulated a half century earlier by Wordsworth and Coleridge; but to a new generation their teaching came with a new value. The preëminence of Rossetti (1828-82) has overshadowed a number of lesser men who yet deserve much more than oblivion—John Lucas Tupper, e.g., an admirable poet now scarcely known, of one of whose lyrics Rossetti himself said that had it been the writing of Edgar Poe it would have enjoyed a worldwide celebrity. But the chief of the school, in spite of gloomy clouds such as in different ways overshadowed the lives of a singularly large proportion of the great authors in the century, produced a large amount of verse characterized alike by poignant appeal to the heart and by gorgeous and colorful word painting. Even more completely than Rossetti, William Morris (1834-96) was attracted by the purely picturesque quality of the Middle Ages; but he is more external, less of a mystic than the others of the group. His strongest point is his consummate ability to tell a smooth and flowing tale, in the manner of Chrétien de Troyes and others of the old French romancers, though with an occasional note of a purely modern pessimism. Greater poets, indeed, there have been; but from Chaucer to our own time, scarcely a greater story-teller in verse.

A similar tendency towards escape from the pressure on the one hand of the colorless materialism of dominant modern science, and on the other of the moral seriousness which characterizes the greater part of the English poetry of the last half century may be found in Swinburne. His mastery of technique, his power of creating marvelous effects of rhythm and melody, are unsurpassed; and the death of Tennyson and Browning left him alone to be the unquestioned chief of English singers, though his rebel attitude towards the social order robbed him of the glory of the laurel. The morbid excesses of his earlier work, conceived in the spirit of a decadent paganism, alienated many readers from him; but they have been succeeded by a noble presentation of higher motives, the characteristically English ones of a love of freedom and of the sea and of the innocent beauty of children. His very power over his instrument has tempted him at times to play tricks with it, to be careless of the sense in the intoxication of a riot of beautiful sounds and sights; but his touch is always that of a master. Promise for the future of English poetry has appeared in the work of Stephen Phillips, Francis Thompson, William Watson, John Davidson, and in the more serious verse of Kipling.

Macaulay has already been mentioned as a type of the English thought of his generation; but he may stand also as a representative in the nineteenth century of that school of historians of which the eighteenth produced such brilliant examples—the artistic school, who rested their claim to distinction more upon their manner than upon their matter. While his style is not perfect, while its recurrent antitheses, its emphasis upon the exceeding blackness of the black and the whiteness of the white, become wearisome after a while, yet he was undoubtedly a great historian—if history be the vivid and delightful narration of past events so presented as to make them fit into the writer's preconceived scheme of things. So was a later example of the method, James Anthony Froude (1818-94); but the new generation has learned (to adopt once more an overworked phrase) that, while such writing may be magnificent, it is not history. Carlyle was not so far wrong when he said that Macaulay had written his history to prove that Providence was on the side of the Whigs; and the deductive method, abandoned long before by science, still reigned in the work of the historian. It was succeeded by the truer method which now holds possession of the field—the calm, patient, minute investigation of the actual records of the period under study, and the presentation of results as found. This reaction, illustrated by the prodigious learning and calm judgment of such men as E. A. Freeman (1823-92), S. R. Gardiner (1829-1902), and William Stubbs (1825-1901), and largely associated with the University of Oxford, has at times, like all literary reactions, shown a tendency to go too far in the opposite direction and present a mere undigested mass of facts; but the scientific securing of them once established, the selection and composition which art requires will, it may be hoped, bring historical writing once more into the higher regions of literature.

In the province of pure literature, that which is cultivated for its own sake, much excellent work has been done by an increasing number of men, and, as already remarked, criticism has become a separate department. While no single

critic holds the supreme dictatorship of Matthew Arnold, a substantial gain has been made by the use of the comparative method, which treats literature not as an isolated phenomenon, but as part of a vast general movement. For adequacy of equipment, George Saintsbury (1845- ) is probably the first of these later critics; but the appreciation of Edmund Gosse (1849- ) and the refined versatility of Andrew Lang (1844-1912), the philosophic insight of Dowden (1843-1913) and Shafrin (1819-85), must have a word of mention. In definite contrast to these, who are men of letters pure and simple, stand the natural scientists and some later philosophers who value the written word only as a means of expression and diffusion for their thought; the names of Darwin (1809-92) and Tyndall (1820-93) and Huxley (1825-95), of Herbert Spencer (1820-1903) and John Morley (1838- ) and Arthur Balfour (1848- ), cannot be passed over in even a purely literary review, so great has been their influence on the general evolution of thought and hence of its expression.

But the novel has in the last generation so overshadowed other forms of literature as to justify its treatment in these closing paragraphs with the same approach to exclusiveness as the drama claimed in the Elizabethan period. It would have been both hopeless and profitless to attempt to enumerate with any fullness of characterization the vast multitude of novelists that the last century has produced, or even the better-known among them—in the earlier period Bulwer (1831-91) and Disraeli (1804-81) and Charles Reade (1814-84), Anthony Trollope (1815-82) and the Brontës (1816-55) and the Kingsley brothers (1819-76); and in more recent times Blackmore and Mrs. Oliphant and Mallock and Black and Mrs. Ward and "Lucas Malet" and especially Kipling, and a score of others whose names will occur to any reader. But there are three names which may fitly receive less summary treatment, because two of them stand at least, after a long diversified career, unquestionably at the head of their craft, and because the third by a beautiful and inspiring life and an intimate charm of personality revealed in every line of his work has also won a very special place of his own. They are singled out also, in accordance with the general scheme of this article, as typical of the attainment and the outlook in their kind of work. The first and possibly the greatest of them, George Meredith (1828-1909), is in some sense the successor of George Eliot—the successor in development, though, for actual chronology, he published his first book before hers appeared. We have already noted her work in the study of social questions and her portrayal of the characteristic mental temper of her day; it remains to call attention, for the connection of thought, to the ethical import of her novels, to her rigorous insistence on the reign of law in the development of moral character. Meredith, though he works not so much through individuals as through types, though his method is often elusive, deals mainly with the inevitable working out and consequence of one or another moral quality. His style is often called obscure, like that of Browning, with whom he has many analogies; but his marvelous insight into the springs of human action, his ripe philosophy, and his genial humor compensate the reader for any effort of attention.

To Meredith, man, his work in the world, his development of himself, is the centre of interest. To an equally great novelist, Thomas Hardy, man is but an insignificant and feeble creature, moving helplessly through a world controlled by gigantic forces, pitiless, implacable—a world conceived in a spirit not unlike that Æschylean gloom and awe of the forces of Nature and Fate which we saw to pervade the poetry of the pagan Saxons. Life to him is pure tragedy, relieved only by flashes of a grim irony as bitter as, though more resigned than, Swift's. His attitude expresses one aspect of the temper of the closing nineteenth century—its weariness of the insistent discussion of questions of right and wrong which so occupied its central period. A totally different means of escape, one offered with the light-heartedness of a child who breaks out from tedious lessons to play, is that of Robert Louis Stevenson (1850-94), the third of the authors chosen to lead to a conclusion. His style is noteworthy for its deliberate artistic finish and grace, qualities which he shared with a brilliant contemporary master of form, Walter Pater (1839-94). It is probable that his essays, in which he expresses a whole, courageous, and hopeful philosophy of life, will in the end hold a higher place than his fiction; but for the moment it will be well to direct the attention to the latter, which marks the rounding off of our survey of the nineteenth century with a return to the romanticism that began it, and reminds us once more of one of the chief functions of all literature, which is to lift us above the sordid atmosphere, the corroding cares of that "struggle for life" which modern science presents to us as our only occupation, into a brighter and more joyous world.

As a last word, certain tendencies that marked the close of the nineteenth and the opening of the twentieth century should be noted. First of all, there was a deepening interest in the drama, as shown by the more serious critical consideration—well represented in the work of William Archer—which it received, and by the demand for plays published in book form; witness the names of Barrie, Yeats, Synge, and Shaw. Barrie was conspicuous and popular by his stagecraft, his romantic fantasy, his grace, and his freshness of invention; Yeats and Synge were inspired by the old romance or the contemporary reality of Celtic Ireland. None of these, however, takes us into the main current of the dramatic activity of the time. It remained for Bernard Shaw to perform that service. In different ways Wilde and Pinero taught the playwright to come to close quarters with contemporary life and were in that regard Shaw's predecessors. But this brilliant and audacious innovator, following the bent of his own genius and stimulated by the best French drama of the day and by the plays of Ibsen, with their deft and fearless criticism of modern life, has given the English drama a new direction, has filled it with new ideas, seasoned it with mordant wit, and has afforded one more illustration of the potent influence of the mood and point of view of the Scandinavian dramatists. It is Shaw and his disciples, Granville Barker conspicuous among them, who exemplify the vital dramatic movement of their day. Another mark of the period in question is the reviving taste for poetry. The pleasure a growing public takes in the work, e.g., of Alfred Noyes, of John Masefield, of Herbert Trench, of Walter De la Mare,

and of A. E. Housman is evidence of this. Another evidence is afforded by the cordial reception given the poets of perhaps the most interesting literary movement of its time, the Irish literary revival, who, heard as a choir in the nineties of the last century, were still vocal in the twentieth, and among whom Yeats, Synge, Moira O'Neil, and "A. E." (G. W. Russell) may be mentioned.

In the fiction which belonged to the vital literature of the time the drift was away from static romance and aimlessly detailed realism, and set strongly towards the concrete and imaginative presentation of the social, ethical, and sentimental problems of the day as recognized by the intellectually conscious classes and especially as related to the readjustment of ideals necessitated by the development and spread of feminism. This tendency is clearly seen in the novels of H. G. Wells, John Galsworthy, and a group of minor novelists who follow in their steps.

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**ENGLISH MERCURY.** See CHENOPodium.

**ENGLISH OPIUM EATER.** See DE QUINCEY, THOMAS.

**ENGLISH PALE**, also known as **IRISH PALE**, **THE PALE**, or **ENGLISH LAND**. That portion of Ireland brought under English rule before the complete conquest of the island. The name Pale was applied to the land until the fourteenth century, although "English land" was employed as early as the time of Edward I. These terms were used to distinguish the section of country around Dublin from the surrounding territories, which were called the "marches," or border lands. In 1366 the Statute of Kilkenny was passed, establishing the use of English law in the Pale and prohibiting intermarriage between English and Irish as well as the adoption of Irish manners and customs. The boundaries of the Pale were at no time definitely determined, but varied with the rise or decline of English power in Ireland and with the military activity of the Norman and Celtic chiefs in the interior. In 1515 the Pale extended from Dundalk, in County Louth, to Dalkey, 7 miles south of Dublin, a stretch of territory about 50 miles long, with an average breadth of 20 miles. In 1535, although the Pale was supposed to contain the counties of Louth, Meath, Kildare, and Dublin, the Irish plundered at the very gates of Dublin. Cromwell was led to subjugate the whole island by the rebellion of the Catholic gentry and their invasion of the Pale. The Pale was subject to the enactments of the Irish Parliament, and for a long time the English government with great difficulty maintained its hold upon it. The supremacy of the English crown in the

Pale was established by the enactment of the celebrated Poynings Law in 1494. Consult Joyce, *Concise History of Ireland* (New York, 1903). See IRELAND.

**ENGLISH POETRY, SPASMODIC SCHOOL OF.** An expression employed by the critics to designate a group of English poets midway in the nineteenth century. The group included Philip James Bailey, Alexander Smith, Gerald Massey, Sydney Dobell, and other minor poets. Swinburne was sometimes classed with them. In ridicule of their extravagance in theme and style W. E. Aytoun wrote a tragedy called *Firmilian* (1854), which, containing many passages of true poetry, rather missed the mark. See the separate articles on the poets here mentioned.

**ENGLISH SNIPE.** Wilson's snipe. See SNIPE.

**ENGLISH SPARROW.** See HOUSE SPARROW.

**ENGLISH VERSIONS.** See BIBLE.

**ENGORGEMENT.** See MEGRIMS.

**ENGRAFTING.** See GRAFTING.

**ENGRAILED,** *en-gräld'* (from Fr. *engrêler*, to engrail, from *en*, in + *grêl*, OF. *gresle*, hail, from OHG. *grîoz*, Ger. *Gries*, AS. *grêot*, Eng. *grit*, gravel). A term in heraldry (q.v.) denoting a line composed of a series of concave semicircles.

**ENGRAVER BEETLE.** See BARK BEETLE.

**ENGRAVING.** The art and the process of making incisions in a hard surface, removing a part of the material. The term is applied also to the engraved block or metal plate, but not properly to the impression made therefrom, the proper designation of which is print (q.v.). Engraving may be divided into that which is done for its own sake, to show in contrast with the smooth surface around, and that which is done for the sake of the prints which may be taken from it. If an engraved surface be covered with ink or wet color, paper or the like pressed upon it will take the impression of the parts remaining untouched, while the hollowed out (engraved) parts will not print off. This is called relief (q.v.). Its most important variety is *line engraving* (q.v.). But if the ink or color be forced into the hollowed parts, while the smooth part is wiped clean, the paper, usually wet, will draw from the engraved lines and spaces the ink which they have contained, while the rest of the paper is left white. This process is properly called *line engraving* (q.v.), sometimes also *copperplate engraving*, because this metal was generally used in the process. If the lines are eaten into the plate by means of an acid, the process is called *etching* (q.v.); if the surface is merely roughened without incision of lines, it is called *mezzotint* (q.v.).

There is still to be mentioned that engraving which is done with the purpose of stamping a soft substance, thereby leaving a relief impression, as in the case of seals. The objects represented are reversed in the engraving. This is the process usually called *intaglio* (q.v.), and it is especially applied to gems (q.v.). Such *intaglios*, however, have frequently been cut for their own intrinsic beauty without intention for use as seals.

Engraving of the kind first above named, viz.; that done for the effect produced on the surface engraved, is seen in its simplest form in the rock carvings of primitive peoples. It is also

seen in the inscriptions of the ancients, particularly of the Greeks and Romans, which were carved not only to read but for their decorative effect. This is also true of inscriptions on tombstones previous to the nineteenth century, the ornamentation and lettering of which are often carved with the utmost delicacy. But all this material is more properly designated carving (q.v.). It is otherwise with the engraving on bronze and steel plate, armor, etc., such as the Orientals, especially the Chinese and Japanese, delighted in. These are true engravings of the most subtle technique. Modern silverware, both of European and American manufacture, is often engraved with fine decorative effect.

But the usual use of the term "engraving," and the one with which we are concerned, is in connection with prints. The four principal processes are treated under the headings *WOOD ENGRAVING*, *LINE ENGRAVING*, *ETCHING*, and *MEZZOTINT*, to which the reader is referred. Certain other processes of engraving receive special treatment, such as *DRY POINT*, *AQUATINT*, *MANIÈRE CRIBLÉE*, *STIPPLE*, and *SOFT-GROUND ETCHING*. Mixed processes, such as a combination of etching with line engraving or etching with mezzotint, are described under the above headings. For a remarkable example of a mixed process, see *LIBER STUDIORUM*. Important technical terms connected with engraving are treated under such special headings as *BURIN*, *PROOF*, *PRINT*, ETC. *Lithography* (q.v.), although a process of printing, is not properly engraving, because no lines are incised. Photographic processes of engraving are treated under the heading *PHOTO-ENGRAVING*.

**History.** The history of the different processes of engraving is described at length under the appropriate headings; suffice it here to say that wood engraving for the purpose of printing first became an art in the early years of the fifteenth century, and that line engraving developed in connection with the art shortly before the middle of the same century. Both seem to have first appeared in Germany, where engraving was frequently practiced, but they appeared shortly afterward in Italy. Both processes reached their highest development during the early part of the sixteenth century in the works of Albrecht Dürer, the world's greatest and most influential engraver. Up to this time engraving was an original art, in the same sense that painting was, and the term "painter engraver" was usually applied to artists of this description. But during the latter sixteenth century engraving began to be used to reproduce paintings; Marc Antonio, the engraver of Raphael's works, leading the way. This practice continued throughout the later sixteenth, seventeenth, and eighteenth centuries, greatly to the detriment of engraving. Meanwhile etching, which, by the nature of its technique, was particularly adapted for original work, attained its highest development in Holland in the prints of Rembrandt. In the early nineteenth century Thomas Bewick, by a new technique—the use of the "white line"—revolutionized wood engraving which thereafter became the principal medium used in illustration. The American wood engravers, working since 1875 for the prosperous illustrated magazines, achieved remarkable results in the reproduction of paintings and even in original portrait and landscape work; but the recently



**"ADORATION OF THE MAGI"**  
FROM AN ENGRAVING BY ALBERT DÜRER





perfected photographic processes of printing tend more and more to deprive wood engraving of its uses for illustration. Line engraving is now practically an obsolete art. Etching, on the other hand, although it declined in the eighteenth century, achieved a remarkable development in the nineteenth, especially through the influence of the American Whistler and the Frenchman Méryon. This excellence has lasted to the present time, both in Europe and the United States.

**Bibliography.** Of general catalogues covering special epochs the most celebrated is Bartsch, *Le peintre-graveur* (21 vols., Vienna, 1803-21), reprinted (Leipzig, 1854), and supplemented by Passavant, *Le peintre-graveur* (6 vols., Leipzig, 1860-64). The French engravers were included in Robert-Dumesnil, *Le peintre-graveur français* (8 vols., Paris, 1835-50); the Flemish and Dutch in Van der Kellen (ed.), *Le peintre-graveur hollandais et flamand* (Utrecht, 1873). The more recent artists are treated in Hippert and Linnig, *Le peintre-graveur hollandais et belge du XIXe siècle* (Brussels, 1874-79); Beraldi, *Les graveurs du XIXe siècle* (12 vols., Paris, 1885-92). The engravers and their works are also treated in such general biographical works as Bryan, *Dictionary of Painters and Engravers* (rev. ed., 5 vols., New York, 1903-05), and, best of all, in Thieme-Becker, *Allgemeines Lexikon der bildenden Künstler* (Leipzig, 1907-).

Other good treatises on the subject are: Fielding, *Art of Engraving* (London, 1840); Duplessis, *Les merveilles de la gravure* (Paris, 1871; Eng. trans., London, 1871); Baker, *American Engravers and their Works* (Philadelphia, 1875); Willshire, *Introduction to the Study and Collection of Ancient Prints* (London, 1877); Hamerton, *Graphic Arts* (ib., 1882); Lostalot, *Les procédés de la gravure* (Paris, 1882); Delaborde, *La gravure* (ib., 1882), trans. by R. A. M. Stevenson, with a chapter on English engraving by William Walker, as *Engraving: Its Origin, Processes, and History* (New York, 1886); Duplessis and Bouchot, *Dictionnaire des marques et monogrammes* (Paris, 1886); Wedmore, *Fine Prints* (London, 1897); Singer and Strang, *Etching, Ingraving, and Other Methods of Printing Pictures* (ib., 1897); Lipinmann, *Engraving and Etching* (Eng. trans., ib., 1906); Whitman, *The Print Collectors' Handbook* (ib., 1907); Weitenkamp, *How to Appreciate Prints* (New York, 1908); Carrington, *Prints and their Makers* (ib., 1912). For modern commercial processes, see Baker, *Dictionary of Engraving* (Cleveland, 1908).

**HISTORY:** The most important general work is Duplessis, *Histoire de la gravure en Italie, en Espagne, en Allemagne, dans les Pays-Bas, en Angleterre, et en France* (Paris, 1888). Briefer historical treatises are Hind, *A Short History of Printing and Engraving* (London, 1908), and Austin, *The History of Engraving* (ib., 1909), a good concise manual extending to the time of Bewick. For engraving in the different countries, see Lützow, *Geschichte des deutschen Kupferstichs und Holzschnittes* (Berlin, 1901); Dilke, *French Engravers and Draughtsmen of the Eighteenth Century* (New York, 1902); Nevill, *French Prints of the Eighteenth Century* (London, 1908); Thomas, *French Portrait Engraving of the Seventeenth and Eighteenth Centuries* (ib., 1910); Gosse, *British*

*Portrait Painters and Engravers of the Eighteenth Century* (New York, 1905); Salaman, *The Old Engravers of England* (London, 1907). The best and most comprehensive publication on recent engraving is Lützow, *Die vielfältigen Künste der Gegenwart* (3 vols., Vienna, 1893)—the part dealing with American engraving is by S. R. Koehler; Weitenkamp, *American Graphic Art* (New York, 1912). For the literature on special branches of engraving, see the bibliographies of WOOD ENGRAVING; LINE ENGRAVING; ETCHING; MEZZOTINT; ETC.

The most trustworthy collection of reproductions of prints from metal engravings is that of Armand-Durand. Other collections are *The British Museum Reproduction of Prints* (London, 1882 et seq.); and Hirth, *Kulturgeschichtliches Bilderbuch aus drei Jahrhunderten* (6 vols., Leipzig, 1882-90).

**ENGROSSING** (OF. *engrossir*, from ML. *ingrossare*, to engross, from Lat. *in*, in + *grossus*, large). The crime of buying up standing corn or victuals at wholesale (Fr. *en gros*) in order to sell them again at retail (known as regrating) in the same market at an enhanced price. It corresponds closely to the modern practice of making a "corner" in one of the necessities of life. These practices were regarded as criminal in most countries before the laws by which trade is regulated were properly understood. In England they were forbidden by various statutes, from the time of Edward VI to that of Queen Anne. It was found, however, that engrossing was not only a statutory but a common-law offense, and a prosecution for it in the latter character actually took place in the nineteenth century. The Act 7 and 8 Vict., c. 24, abolishing the offenses of forestalling, regrating, and engrossing, was consequently passed. Besides declaring that the several offenses of badgering, engrossing, forestalling, and regrating be utterly taken away and abolished, and that no information or prosecution shall lie either at common law or by virtue of any statute, either in England, Scotland, or Ireland, this statute also repeals a host of earlier enactments in restraint of trade, which had been omitted in the statute in the time of George III, above referred to. In the United States much litigation has arisen in recent years respecting the combinations for engrossing and the necessities of life. See COMBINATIONS; MONOPOLY; RESTRAINT OF TRADE; TRUSTS. See also CONTRACT; FORESTALLING; REGRATING. Consult the commentaries of Blackstone, Stephen, and Kent, and the authorities under CRIMINAL LAW and POLITICAL ECONOMY.

The term also denotes the writing of a statute or other legal instrument *en gros*, or in a fair, round hand. It is, in the United States, often applied to the final and official draft of a statute.

**ENGUINEGATTE.** See GUINEGATE.

**ENGUION**, or **ENGUIM**, or **ENGYON.** See GANGL.

**EN'HARMONIC** (from Gk. *ἐναρμονικός*, *enarmonikos*, in harmony, from *ἐν*, *en*, in + *ἀρμονία*, *harmonia*, harmony, from *ἀρμός*, *harmos*, a joining, from *ἀειν*, *aein*, to be about to join). 1. In music, a term denoting a difference in the degrees, but not in the pitch of tones, C# and Db, F# and Gb. Correctly speaking, there is or ought to be a difference; but on keyed instruments, such as the organ and pianoforte, there can be none, as the same key serves for both sharps and flats, while with a just equal tem-

perament the ear is no way offended. An enharmonic change, as from C# to Db, or vice versa, is often of practical value to the musician, enabling him, e.g., to avoid writing in a key containing an unwieldy number of sharps or flats. 2. In Greek music, a tetrachord of which the first two steps were quarter steps and the third a major third: e, e#, f, a.

**ENHUBER**, en'huo-bër, KARL VON (1811-67). A German genre painter and illustrator. He was born at Hof, Bavaria, and was educated at the Munich Academy. His pictures, distinguished by a lively, if somewhat ponderous, sense of humor, portray German folk life—usually that of the peasants of Upper Bavaria. Among the best are: "The Partenkirchen Fair," which first gained him celebrity; "The Interrupted Card Party"; "The . . . Carver"; "Munich Burgher Guardsman" (National Gallery, Berlin); "Court Day in Bavaria" (Darmstadt Gallery); "Wood Carver in his Shop" (New Pinakothek, Munich). His most important graphic work was the illustrations to Melechiore Meyr's *Stories of the Ries*, six plates of which are in the Leipzig Museum.

**ENID**. The wife of Geraint, and a model of marital devotion. She appears in the *Erec and Enide* of Chrestien de Troyes and in Tennyson's *Idylls of the King*.

**ENID**. A city and the county seat of Garfield Co., Okla., 88 miles by rail west by north of Oklahoma City, on the Atchison, Topeka, and Santa Fe, the Chicago, Rock Island, and Pacific, and the St. Louis and San Francisco railroads (Map: Oklahoma, D 2). It is in a rich agricultural region and is one of the largest poultry centres west of the Mississippi, shipping in 1913 more than \$3,000,000 worth of poultry and eggs. The industrial establishments include planing and flour mills, foundry and machine shops, boiler works, a brick plant, and manufacturing of corn seeders and binders, steel posts, rugs, candy, etc. Enid contains the Phillips University, St. Francis Institute (Catholic), College of Fine Arts, a State institution for the feeble-minded, a Carnegie library, a fine high school, Federal and courthouse buildings, two parks, and two hospitals. The city adopted the commission form of government in 1909. It owns its water works. Pop., 1900, 10,087; 1910, 13,799; 1914 (U. S. est.), 18,209.

**ENIMÁGAN**. A linguistic stock of South American Indians in the northern Gran Chaco, the "Maskoi" group of Koch-Grünberg. The chief tribes are the Enimá, Guaná, Sanapana, Sapuki, . . . , "Lengua." Consult writings of Boggiani, Hawtrey, Kersten, Koch-Grünberg, Lafone-Quevedo, Schuller, etc.

**ENKHUIZEN**, ênk'hoi-zen. A seaport of the Netherlands, in the Province of North Holland, situated on the west shore of the Zuider Zee, about 37 miles northeast of Amsterdam (Map: Netherlands, D 2). Its most important public building is an elegant town house with a lofty tower, and mural decorations by Johan van Neck. In the seventeenth century it had a population of upward of 40,000 and sent a fleet of 100 vessels to the herring fisheries, but the herring trade has died away. Its chief industries now are ropemaking and shipbuilding. The town is the birthplace of the painter Paul Potter. Pop., 1901, 6865; 1911, 7748.

**ENLIGHTENMENT, PHILOSOPHY OF THE**.

A term applied to the more popular philosophy of the eighteenth century because of its protest against superstition and its attempt to establish all accepted belief and all rules of practical life upon reason. The term includes the empiricism and deism of the English thought of the eighteenth century, the empiricism and sensualism of the French thought, and the rationalism of the German thought. It was characterized largely by individualism (q.v.). The movement began in the seventeenth century with Locke in England, with Pierre Bayle in France, and with Leibnitz in Germany. But such men as Hume, the English deists, Voltaire, Rousseau, Condillac, the encyclopædists, Reimarus, Mendelssohn, Eberhard, and Lessing, are usually referred to under this title, represented in German by *Aufklärung* and in French by *éclaircissement*. Thomas Paine in his *Age of Reason* and Benjamin Franklin are its best-known American representatives. Sometimes the age of the Greek sophists is called "the Greek enlightenment" on account of its similarity in spirit to the modern period referred to. Greek sophistry in its best days was a rebellion against tradition and an attempt to intellectualize life. Consult the histories of philosophy by Höffding, Windelband, Ueberweg, and Kuno Fischer; also Hibben, *The Philosophy of the Enlightenment* (New York, 1910).

**ENLISTMENT**. The voluntary contract by which a citizen becomes an enlisted man and joins the military or naval forces of the country. In the United States and Great Britain voluntary enlistment takes the place of conscription, or compulsory service, used by all the other Great Powers as the method of securing men for the army and navy. (See CONSCRIPTION.) In the United States any male citizen, or person who has legally declared his intention to become a citizen, may enlist in the army if above the age of 21 and under 35 years of age, able-bodied, free from disease, of good character and temperate habits. No man is eligible who has been convicted by civil power of felony or served time in a reformatory, jail, or penitentiary. He must speak, read, and write the English language. The physical examination of recruits is conducted in accordance with the authorized manual for the examination of recruits. After enlistment, recruits are assigned to regiments or other organizations by the adjutant general of the army under the direction of the Secretary of War. The recruiting service is under the management of the adjutant general, and is a branch of the adjutant general's department. Recruits have to conform to certain standards of build and physique, determined generally by the branch of the service for which the man is enlisted. The term of enlistment is "for a period of seven years in active service and in the army reserve." Active service in the army is for either three or four years, the remaining four or three years being in the army reserve, where no military duty is required, and in which the soldier practically resumes the status of a civilian, being subject to military service only in case of war. Additional pay for all grades is allowed for reenlistments within three months of expiration of preceding enlistment. In the English army, under the Law of 1907, which discontinued the militia and established a special reserve, the military forces consist of the regular army and the territorial army. The regular army is composed of the permanent

army, the army reserve, and a special reserve. Duration of service in the permanent army is 12 years, of which three, five, or nine years may be in the reserve. All good-conduct men may serve a total of 21 years, with pension. Ordinarily in the colonies and in India the service is from 12 to 16 years. The special-reserve enlistment is for six years. The territorial army enlists for four years. See RECRUITMENT.

In the naval service of the United States all men are enlisted to serve for four years, which may be extended by the Secretary of the Navy for one, two, three, or four years. Upon reenlistment they are entered continuous-service men, and are given a certificate of continuous service, which entitles them to an increase of monthly pay. This increase is given for each term of four years served if the reenlistment takes place within four months of discharge. Failure to enlist within four months causes a forfeiture of all rights and privileges due to previous service.

**ENNA**, or **HENNA**. In antiquity, the name of a town in Sicily, now Castrogiovanni, situated near the centre of the island, wherefore it was called the navel of Sicily. It was one of the seats of the cult of Demeter, and near it tradition placed the carrying off of Persephone by Pluto. See CERES; PROSERPINA; CASTROGIOVANNI.

**ENNA**, AUGUST (1860- ). A Danish composer, born at Nakskov on the island of Lolland. He was entirely self-taught and in 1880 joined a traveling troupe as violinist. The next year he settled in Copenhagen, where he earned his living as a violinist, and produced an operetta, *A Village Tale*. In 1883 he became conductor of a small provincial company. His compositions finally attracted the attention of Gade, who enabled him to study one year in Germany (1888-89). The extraordinary success of his opera *The Witch* (1892) made him famous, and the work immediately found great favor in Germany. His other operas are: *Oléopatra* (1894); *Aucassin et Nicolette* (1896); *Lamia* (1900); *Id and Little Christina* (1902); *The Death of Antony* (1903); *The Golden Slipper of St. Cecilia* (1904); *Gloria Arsena* (1913). While all have met with more or less success, none approach *The Witch*. He also wrote a legend for soli, chorus, and orchestra, *A Mother's Love*, and a violin concerto.

**ENNEACRUNOS**, ἐννέα-κρουνός ('Ennéa-krounos, having nine springs, from ἐννέα, ennea, nine + κρουνός, krounos, spring). The name of a famous fountain at Athens. See ATHENS, *Archæology*.

**ENNEKING**, JOHN JOSEPH (1841- ). An American landscape painter, born at Minster, Ohio. He was educated at Mount St. Mary's College, Cincinnati, served in the Civil War, and later devoted himself to painting. He studied in New York, Boston, Munich, and in Paris under Bonnat and Daubigny. Among his best pictures are: "November Twilight"; "Summer Twilight"; "Indian Summer"; "The Coming Storm"; "Springtime"; and "Autumn in New England" (Worcester Museum).

**ENNEMOSER**, ἐννεμόζερ, JOSEPH (1787-1854). A German medico-philosophic writer, born at Hintersee, in the Tirol. He pursued his studies under great difficulty for want of means and because of interruption by war. He fought with the Tyrolese against the French in 1809 and also fought against Napoleon in 1813-14.

He received his degree in medicine in Berlin in 1816. In 1819 he was made professor of medicine at the new University of Bonn, where he lectured on anthropology and also therapeutics and pathology. After practicing for a time as a physician at Innsbruck, he went to Munich in 1841, and there obtained a great reputation by the application of hypnotism (then called magnetism) as a curative agency. His principal work, published in Leipzig in 1819, was entitled *Der Magnetismus in seiner geschichtlichen Entwicklung* (1819). Among his other writings are: *Historisch-psychologische Untersuchungen über den Ursprung und das Wesen der menschlichen Seele* (1824); *Anthropologische Ansichten zur bessern Kenntnis des Menschen* (1828); *Der Magnetismus im Verhältnis zur Natur und Religion* (1842); *Der Geist des Menschen in der Natur* (1849); *Was ist die Cholera?* (2d ed., 1850); *Anleitung zur mesmerischen Praxis* (1852). The first volume of his *Geschichte des tierischen Magnetismus* (1844) was translated into English by William Howitt (1854) and entitled *History of Magic*.

**ENNES**, ἐν'νήσ, ANTONIO (1848-1901). A Portuguese dramatist, born in Lisbon. He was long brilliantly active as a journalist, in 1886 was appointed chief librarian of the National Library, and in 1890 Minister for Marine and the Colonies. His chief drama is *Os Lazaristas* (1874), presented with marked success in Portugal and Brazil. His *Un divorcio* appeared in 1879 and was translated into French and Italian.

**EN/NIS**. A municipal borough, capital of Clare County, Ireland, and a port on the Fergus, 25 miles west-northwest of Limerick (Map: Ireland, B 6). It has a Roman Catholic college, the ruins of a Franciscan abbey, founded in 1194 by Donnell O'Brien, King of Munster, and a colossal statue and monument to Daniel O'Connell, erected in 1865. Near the town is Ennis College, founded by Erasmus Smith. Ennis manufactures flour, and brewery and distillery products, has a valuable limestone quarry, and some trade in grain. Pop., 1901, 5093; 1911, 5472.

**EN/NIS**. A city in Ellis Co., Tex., 34 miles south of Dallas, on the Houston and Texas Central and the Texas Midland railroads (Map: Texas, D 3). It is in an agricultural and stock-raising region and has cotton compresses, cotton gins, cottonseed-oil mill, railroad shops, flouring mill, etc. Ennis adopted the commission form of government in 1914. Its water works are the property of the municipality. Pop., 1900, 4919; 1910, 5669.

**EN/NISCOR/THY**. A market town in Wexford County, Ireland, on rising ground on the Slaney, 77½ miles south by west of Dublin (Map: Ireland, E 7). The Slaney is here tidal and navigable for barges and flows through a fertile and beautiful valley. Its well-preserved castle, founded in 1176 by Robert le Gros, one of the early Anglo-Norman invaders, is of great interest. It has flour mills and breweries, and there is some tanning and distilling, as well as woolen manufacture. Pop., 1901, 7667; 1911, 7991. Enniscorthy was captured in 1649 by Cromwell, and at Vinegar Hill, in the vicinity, General Lake, on June 21, 1798, defeated the Irish rebels, who had stormed and burned the town a few days previously.

**ENNISKILLEN**, or **INNISKILLING** (Ir. *Inis Cethlenn*, island of Cethlenn, an ancient

queen of Ireland). A municipal borough, market town, and the capital of County Enniskillen, Ireland, about 75 miles west-southwest of Belfast (Map: Ireland, D 3). It is beautifully situated on the Erne, the greater portion on an isle in the river between upper and lower Loughs Erne. Among its buildings are large barracks, an infirmary, and the town hall, in which are kept flags captured at the battle of the Boyne. It has tanneries, cutlery works, straw-hat works, and markets for butter, pork, and flax. Pop., 1901, 5412; 1911, 4847. Enniskillen received its first charter in 1612. In 1689 a detachment of troops of William III successfully defended the place against a superior force of James II. Some of its defenders subsequently formed a cavalry regiment and organization, which was continued and still bears the name of the Enniskillen Dragoons.

**ENNIUS, QUINTUS** (239-169 B.C.). An early Roman poet, the father of the Roman epos. (See **EPIC POETRY**; **LATIN LITERATURE**.) He was born at Rudiae in Calabria and was probably of Greek extraction. He is said to have served in the Roman wars and to have risen to the rank of a centurion. In Sardinia he became acquainted with Cato the Elder and came with him to Rome, when about the age of 38. Here he gained for himself the friendship of the most eminent men, among others Scipio Africanus the Elder, and attained the rank of a Roman citizen. He supported himself by instructing some young Romans of distinguished families in the Greek language and literature, his accurate knowledge of which explains the influence he had on the development of the Latin tongue. His remains were interred in the tomb of the Scipios, and his bust was placed among those of that great family. Ennius tried his powers in almost every species of poetry; although his language and versification are at times rough and unpolished, these defects are fully compensated for by the energy of his expressions and the fire of his poetry. He was especially successful in tragedy and epic. His epic poem, the *Annales*, in 18 books, dealt with the history of Rome from the time of Aeneas to his own day. By reason of this poem, long highly esteemed, the Romans called Ennius the father of Roman poetry; Vergil owed much to it. Of his tragedies, comedies, satires, and *Annales* only fragments remain. These have been collected and edited by Vahlen (Leipzig, 1854; 2d ed., 1903), Müller (St. Petersburg, 1885), and in Postgate's *Corpus Poetarum*, vol. i (London, 1893). The fragments of his tragedies were collected by Ribbeck in his *Tragicorum Romanorum Fragmenta* (3d ed., Leipzig, 1897). Consult: Sellars, *Roman Poets of the Republic* (3d ed., Oxford, 1889); Mackail, *Latin Literature* (New York, 1896); Duff, *A Literary History of Rome* (London, 1909). For an elaborate account of his life and of his influence on later writers, consult "Prefatio" to Vahlen, *Ennianae Poesis Reliquiae* (Leipzig, 1903), and the review of that discussion by Knapp, in an article on "Vahlen's Ennius," in *American Journal of Philology*, vol. xxxii (New York, 1911).

**ENNO'DIUS, MAGNUS FELIX** (c.473-521). A bishop of Ticinum (Pavia). His writings suggest that he may have been trained for the profession of rhetoric. He took deacon's orders at about the age of 20. In 514 Pope Hormisdas appointed him Bishop of Ticinum. He was twice sent as Ambassador to Constantinople (515

and 517), but his efforts to heal the schism then existing between the Eastern and the Western church were fruitless. In his doctrinal views Ennodius inclined towards semi-Pelagianism. He is best known as a champion of the papacy, especially in its claim to exemption from all human jurisdiction. This claim he was the first to advance, in his apology for the Synodus Palmaris (501 A.D.), held for the purpose of deciding between two rivals for the office of Roman bishop. The synod refused to pronounce a decision on the question, and Ennodius defended its action on the ground that the Pope was not answerable to a council, or in fact to any earthly tribunal, for God had reserved the popes for judgment by Himself alone.

Among Ennodius' writings are a life of Epiphanius, his predecessor at Ticinum; an autobiography of his early life, entitled *Eucharisticum*; many letters; a few hymns, which were never widely used; and some secular poems, which are in part thoroughly pagan. The old editions of his works (1509 and 1611, the latter reprinted by Migne, in *Patrol. Lat.*, vol. lxiii) have been superseded by those of Hartel, in *Corpus Scriptorum Eccles. Lat.*, vi (Vienna, 1882), and Vogel, in *Monum. Germ. Auctorum Antiquiss.*, vii (Berlin, 1885). Consult: Ebert, *Geschichte der Literatur des Mittelalters*, i (Leipzig, 1889); Hasenstat, *Studien zu Ennodius* (Munich, 1890); Teuffel, *History of Roman Literature* (London, 1892).

**ENNS**, or **ENS**, *éns*. A river of Austria, rising south of Radstadt, in the Noric Alps, and flowing east-northeast to the northern part of Styria to Hiefau, then turning and pursuing a sinuous northerly course through Upper Austria, emptying into the Danube near Mautausen (Map: Austria, D 2). Its total length is about 150 miles, only 20 of which are navigable for large boats. Through part of its course it forms the boundary between the provinces of Upper and Lower Austria. It becomes navigable for small river craft some distance below Hiefau. Of the large number of towns and villages on its banks, Steyr is the most important.

**E'NOCH** (Heb. *Hanok*). According to Gen. iv. 17-18, Enoch is the son of Cain and father of Irad, whereas in Gen. v. 18 he is the son of Jared. Some scholars consider Gen. iv as a relic of an ancient legend which endeavored to trace, after the fashion of folklore, the origin of civilization, or rather the Canaanitish culture, and ascribed some important feature of this civilization to Enoch. In Gen. v Enoch is said to have lived 365 years and walked with God, after which he was no more, "for God took him" (verse 24), a phrase that has been understood to mean that he was "translated," or carried bodily to heaven. Babylonian legends in which we encounter such "translations" have been thought to offer a partial explanation at least of the Enoch narrative. In the Gilgamesh epic Ut-napishtim, the hero of the deluge, is transported to the gods, and Gilgamesh himself, the hero of the epic, who is a semi-mythical character, also appears to have been translated. The number 365 adds weight to the supposition that Enoch was originally a solar deity like Gilgamesh, who from a god became a hero. Whether the name Enoch itself reverts to a Babylonian prototype cannot yet be determined, though there is some connection, without doubt, between the list of 10 patriarchs in Gen. v and

the 10 antediluvian kings mentioned by Berosus in his history of Babylonia, and also in a Sumerian text discovered by Poebel and published by him in vol. vi of the *Babylonian Publications of the University of Pennsylvania* (Philadelphia, 1913). The translation of Enoch, which bears a great part in Jewish and early Christian theology, is mentioned in Eccles. xlv. 16, xlix. 14, and also in Heb. xi. 5. From the fact that Enoch, like Elijah, does not die, but is transported to heaven, the apocalyptic literature naturally connected itself with his name. But the other side of Enoch, as a promoter of civilization, was not lost sight of. To the later Jews Enoch was the inventor of writing, arithmetic, and astronomy; and this view was adopted by the Mohammedans, by the Christians, and by the pagans of Harrañ, who identified him with Hermes Trismegistus. Consult Chwolson, *Die Ssabier und der Ssabismus*, vol. i, pp. 627 ff. (Leipzig, 1856), and Schmidt, *The Original Language of the Parables of Enoch*, p. 331 (Chicago, 1908). See ENOCH, BOOKS OF.

**ENOCH, BOOKS OF.** The statement in Gen. v. 24 that "Enoch walked with God, and was not, for God took him," interpreted as referring to his translation, made it natural that, in an age favorable to the production of apocalyptic literature, books should appear claiming the authority of the mysterious patriarch who enjoyed unrivaled opportunities of moving about in celestial realms, learning astronomical facts, observing the punishments and rewards meted out to men and angels, reading the tablets of destiny, and foreseeing the triumph of good in the world. How extensive the Enoch literature once was is not now known, but there are indications in ancient quotations that some parts of it have not yet been recovered. What is really a little collection of such books has been found in the Ethiopic, and one of these almost complete in the Greek, while a different book has been discovered in the Old Slavonic. It is customary to speak of the former as Ethiopic Enoch and the latter as Slavonic Enoch.

**Ethiopic Enoch.** Copies of this work were seen in Europe by Pico della Mirandola and Guillaume Postel long before it was discovered in Abyssinia by James Bruce in 1769. From one of the manuscripts brought to England by him Laurence published the Ethiopic text in 1838; Dillmann used five manuscripts in his edition of 1851, Flemming 15 in his edition of 1902, and Charles 23 in the last edition of 1906. Twenty-nine manuscripts were used by Charles in his translation of 1912. None of these is earlier than the sixteenth century; even the older group does not inspire the greatest confidence, and all manuscripts have evidently suffered much at the hands of copyists. The Ethiopic work is divided into five books. These seem to have been the only Enoch books known in the Abyssinian church. How the Greek version was constituted we do not know. Some copies of it may have contained "The Secrets of Enoch," preserved in Slavonic; whether any of them contained "The Parables of Enoch" is doubtful; various books may have circulated separately, and there is no evidence that any Greek manuscript was divided into five books. Since the Parables were introduced as "the second vision that Enoch saw," some Ethiopic editor naturally made them follow book i. The whole work was divided by Dillmann into 108 chapters; a manuscript was subsequently found

exhibiting the same division. *Book i* (chaps. i-xxxvi) deals with the fall of the angels, and the journey of Enoch through the earth in the company of an angel by whom he is initiated into the secrets of nature. Sin in the world is said to have been caused by the lust of the angels. Hence they were doomed to destruction, and in addition the deluge was sent to complete the first judgment of the world. Through the evil spirits, born of the children of the angels and the daughters of men, sin continued in the world after the deluge. A final judgment is therefore needed. This will take place on Mount Sinai, and angels, demons, all the godless, and all classes of Israel, with one exception, will be raised from the dead and receive their reward. The wicked will be cast into Gehenna, the righteous will behold their punishment, God will establish His kingdom in Jerusalem, the Gentiles will be converted, and the just will enjoy the greatest material blessings, eating of the tree of life, and begetting 1000 children. Of the Greek version of this book fragments have been preserved in Syncellus, viz., vi-x, 14, xv, 8-xvi, 1, and viii, 4-ix, 4 in a duplicate form, and the larger part of the book in manuscripts discovered at Akhmim in 1886-87, viz., i-xxxii, 6, and xix, 3-xxi, 9 in a duplicate form. The Syncellus fragments represent a somewhat better translation. *Book ii* (chaps. xxxvii-lxxi) contains, after an introduction (xxxvii), three parables (xxviii-xliv, xlv-lvii, and lviii-lxix) and two appended sections (lxx and lxxi). It holds a unique place in the Enoch literature by the close similarity of its Messianic ideas to those found in the New Testament. The Messiah is preëxistent, sits on the throne of God, possesses universal dominion, all judgment is committed unto Him, He slays the wicked by the word of His mouth, His kingdom is eternal, and He will dwell among the elect in a new heaven and a new earth. But the text has suffered greatly from interpolations, and it is extremely difficult to determine what its original form may have been. Chaps. lx, lkv-lxix, 25 come from a Noah Apocalypse, and xlix, 1-2a, liv. 7-lv, 2 probably have been derived from the same source. The "son of man" sections also appear to be interpolations—some of them Jewish, some Christian. *Book iii* (chaps. lxxii-lxxxii) treats of astronomy and the phenomena of the seasons. *Book iv* (chaps. lxxxiii-lc) describes the course of history from the beginning unto the end in visions, the leading actors appearing as animals, for the most part easily recognizable. There will be a last struggle between Israel and its enemies; then God will appear, the hostile army will be swallowed up by the earth, the wicked shepherds and the fallen angels will be punished; God will set up a new Jerusalem, the Gentiles will be converted and serve Israel, the dispersed Jews gathered together, the righteous dead raised to life again, and, finally, a ruler will come forth from the community, and all the righteous will be transformed into his likeness. A Vatican manuscript contains a fragment of the Greek version, consisting of lxxxix, 42-49. *Book v* (chaps. xci-cviii) contains a series of admonitions by Enoch to his children, prophecies of the final judgment, and assurances to the righteous of a life in companionship with the hosts of heaven. Chap. cv seems to be an addition; in the last verse the Lord promises: "I and my



Son will be with them"; chaps. cvi-cvii are taken from the Book of Noah. A Latin fragment, published by James (*Texts and Studies*, ii, 1893), contains cvi, 1-18, much shorter and yet with additional material, giving an idea of how different a book of this kind in the Latin version may have been from the text preserved in Abyssinia. Chap. cviii is another addition intended to encourage the righteous to hope in spite of the delay in the coming of the kingdom.

As to the original language of the Ethiopic Enoch, the idea occasionally expressed in the past that it was Greek has no defenders at present, all competent judges agreeing that it is likely to have been either Hebrew or Aramaic. Three scholars have examined the question more extensively and published their conclusions. Halévy in 1867 maintained that the entire work was written in Hebrew; Schmidt in 1908 gave reasons for thinking that the various books, and particularly the Parables, were written in Aramaic; and Charles in 1913 favors Aramaic for chaps. vi-xxxvi and somewhat less positively for book iv, but Hebrew for the rest. In view of the different origin and date of the five books it is not impossible that some were written in Hebrew and others in Aramaic. Charles thinks that the Maccabæan struggle, like similar movements for independence, caused a revival of the national language, and that consequently, while Aramaic might be used in book i, which he considers pre-Maccabæan, Hebrew is more likely in the later books ii, iii, and v. But Jesus Siracides wrote in Hebrew c.180 B.C., the author of Daniel vii in Aramaic after the Maccabæan uprising had begun (see DANIEL, BOOK OF), and even Charles thinks it possible that book iv was written at that time in Aramaic. If one writer could make Enoch prophecy in Aramaic, another could; it is by no means certain that book i is pre-Maccabæan; the Aramaic had not been imposed upon the Jews by arrogant enemies, and it continued for many centuries to be their vernacular; and the political and religious reaction was chiefly directed against Greek language, thought, and customs, not against Aramaic, though it may have increased the interest in Hebrew. The linguistic evidence is not equally strong in all of the books and can scarcely be said to be absolutely conclusive anywhere. Yet there can be little doubt that the earliest Enoch book known to us was written in Aramaic; book iv was probably also written in Aramaic. If Jubilees (q.v.) was written in Hebrew, book iii is likely to have been written in the same language. There are indeed some indications that seem to point to a Hebrew original for books iii and v (without the additions). So far as books i, iii, iv, and v are concerned, there is therefore at present a practical agreement between Charles and Schmidt; but in regard to the Parables (book ii) their views still differ. There are numerous peculiarities that can be explained either by a Hebrew or an Aramaic original, but some that seem to require an Aramaic. The question would be practically settled if Schmidt's suggestion that the Ethiopic text of book ii may not have been translated from a Greek version should prove to be correct. He was led to this conclusion by the absence of any signs of acquaintance with the Parables in patristic literature and the remarkable correspondence between the three Ethiopic terms used for "son of man" and three expressions found in the Aramaic, but not in

the Hebrew. He called attention to the startling fact that none of the many teachers in the early Church who quoted the Book of Enoch by name, and no patristic writer showing any familiarity with the Enoch literature, reveals the slightest acquaintance with this particular book, in spite of the fact that its conception of the Messiah, so vastly nearer to Christian ideas than anything else in Jewish literature, would naturally have invited quotation. It is not sufficient to cite the identical expressions in the New Testament. Enoch is quoted only by Jude, and he does not draw upon the Parables; and it is far more difficult to conceive of a Greek version of the Parables being used by several New Testament writers without mention of the work and then totally disappearing, while other parts of the Enoch literature, not thus honored, were preserved and highly prized, than that the present Ethiopic text has here and there received, in the course of transmission, a certain coloring by Christian hands. When Tertullian says that Enoch prophesied concerning the Lord, he probably thought of the passage also quoted by Jude from book i. Charles assumes that book ii was originally written in Hebrew, that there was a Greek version possibly as early as the first century B.C., that in it the Messianic title *ὁ υἱὸς τοῦ ἀνθρώπου* (*ho huios tou anthrōpou*), "the Son of Man," was uniformly used, and that the Ethiopic translation was made by an Aramaic-speaking Jew who, familiar with the Aramaic expressions *bereh de nasha*, *bereh de gabra*, and *bereh de barnasha*, rendered the same Greek title with the Ethiopic expressions exactly corresponding to these Aramaic terms. But an Aramaic-speaking Jew would not have thought of, or understood, these grammatical curiosities by which men attempted to render the New Testament title unless he was a Christian, and, if he was a Christian, he must have had some reason in the text before him for not using everywhere the title uniformly employed in the Ethiopic New Testament. The probability is against the theory of Charles; but only the discovery of the original or of the Greek version, if there was one, can settle the problem, which is of great importance, not only for this book, but for the origin of the title in the New Testament.

As to the date of the different books, there is to-day a general agreement that books i and iv are the earliest, and that book ii is the latest of the five. A difference of opinion, however, exists in reference to the precise dates. While some scholars think that book i is pre-Maccabæan and book iv earlier than 161 B.C., others hold that these books were written in the time of John Hyrcanus (134-104 B.C.). The former base their argument upon the existence of a strongly organized Chasidean party in the beginning of the second century B.C., for which the latter cannot find sufficient evidence (see CHASIDS); and the former interpret the great horn in xc, 9 as referring to Judas Maccabæus, while the latter understand it as referring to John Hyrcanus. Book i may have been written c.120 B.C., book iv c.108 B.C.; book iii is quite generally assumed to have been written c.100 B.C., and book v is likely to be somewhat younger. More radical is the divergence of opinion as regards book ii. The Christian origin of the whole book, once advocated by many students, is scarcely maintained by any

one now. But while some eminent scholars, like Dillmann, Charles, Beer, and Martin, have held that the Parables were written in substantially their present form before 64 B.C., others, like Krieger, Holtzmann, Baldensperger, and Schürer, have assigned them to the age of Herod. The first group looks upon "the kings and the mighty," often mentioned, as the later Hasmonaans and the Sadducees; the second sees in them references to the Roman rulers. The difficulty with the former interpretation is that it is not easy to see how Alexander Jannæus and his Sadducean supporters can be spoken of as "the kings and the mighty ones in the earth" and charged with putting their "faith in the gods they have made with their own hands" (xlii, 7). If the Roman emperors and provincial governors are intended by "the kings and the mighty," the persecutions of the congregations of the righteous would seem to point to the time of Caligula rather than that of Augustus and Tiberius. The reference to the Parthians (lvi, 5) would be possible at any time after their power had been felt in the land as it was in 40-37 B.C.; if *Nero redivivus* is thought of, the passage may be an interpolation. A decisive evaluation of the internal evidence is made extremely difficult by the question as to the integrity of the text, which fairly thrusts itself upon every investigator. Aside from the Noachic interpolations, long recognized, many other additions have been discerned, and at present there is a tendency to look upon the "son of man" passages as coming from another author than the writer who speaks of the Messiah as the "Elect One." There is often as good manuscript authority for "the chosen ones" as "the Chosen One," and it is quite doubtful whether the original work referred to the Messiah rather than to the chosen people. The "son of man" passages are probably all of them later, but they manifestly do not all come from the same hand. Some of them do not go beyond the conception of the Messiah found in IV Esdras and the Syriac Baruch, written in the reign of Domitian, while others, loosely attached to the context, and reminiscent of New Testament phraseology, seem to be of Christian origin. The Parables have evidently been worked over already in the Aramaic original. In its simplest form the book may have been written by a Jewish author in the time of Caius Caligula (37-41 A.D.), interpolated perhaps not long after Nero's death (68 A.D.) by another Jewish writer, gone through Christian hands, suffering some changes, and found its way through Aramaic-speaking Jewish-Christian missionaries to Abyssinia. Having been rendered by these into Ethiopic, the book may have been given its place in the collection because of its reference to the second vision that Enoch saw. Finally, some copyist seems to have interpolated here, as in other books, extracts that seemed suitable from an apocalypse of Noah, probably translated from the Greek. This possibility, and the growing conviction on the part of scholars that the Parables have not escaped the usual fate of apocryphal literature, serve as a warning against the reliance upon them as *in toto* an expression of pre-Christian Jewish opinion. On the Noachic fragments, see NOAH, Book of.

**Bibliography.** The Ethiopic text was edited by Laurence (Oxford, 1838). Dillmann (Leipzig, 1851), Flemming (ib., 1902), Charles (Oxford,

1906); the Greek text by Bouriant (Leipzig, 1892, and in facsimile, 1893), Dillmann (ib., 1892), Lods (Paris, 1893), Charles (Oxford, 1893), Radermacher (Leipzig, 1901). There are translations in English by Laurence (Oxford, 1838), Schodde (Andover, Mass., 1892), and Charles (Oxford, 1893; 2d ed., 1912); in German by Hoffmann (Jena, 1833-38), Clemens (Stuttgart, 1850), Dillmann (Leipzig, 1853), Beer in Kautzsch's *Apokryphen und Pseudepigraphen des Alten Testaments* (Leipzig, 1902), Flemming and Radermacher (Leipzig, 1902); in French by Brunet in Migne, *Dictionnaire des Apocryphes* (Paris, 1856); Lods, of the Greek text, chaps. i-xxxii (ib., 1892), Martin (ib., 1906); in Hebrew by Goldschmidt (Berlin, 1892); in Latin by Silvestre de Sacy in *Magasin encyclopédique*, pp. 382 ff. (Paris, 1800, 15 chaps. only), Gröber, in *Prophetæ Veteres Pseudepigraphi* (Stuttgart, 1840), and Székely, in *Bibliotheca Apocrypha* (Freiburg, 1913). Consult also De Sacy, in *Journal des Savans* (Paris, 1822); Murray, *Enoch Restitutus* (London, 1836); Krieger, *Beiträge zur Kritik* (Nürnberg, 1845); Lücke, *Einleitung in die Offenbarung des Johannes* (2d ed., Bonn, 1852); Ewald, *Abhandlung über des äthiopischen Buches Henoch Entstehung* (Göttingen, 1855); Hilgenfeldt, *Die jüdische Apokalypik* (Jena, 1857); Halévy, in *Journal Asiatique* (Paris, 1867); Tideman, in *Theologisch Tijdschrift* (Leiden, 1875); Drummond, *The Jewish Messiah* (London, 1877); Baldensperger, *Das Selbstbewusstsein Jesu* (3d ed., Strassburg, 1903); Appel, *Die Komposition des äthiopischen Henochbuches* (Gütersloh, 1906); Schmidt, *The Original Language of the Parables of Enoch* (Chicago, 1908); Schürer, *Geschichte des jüdischen Volkes*, iii (4th ed., Leipzig, 1909); Charles, in *Old Testament Apocrypha and Pseudepigrapha* (Oxford, 1913).

**Slavonic Enoch.** In 1880 Popov published *The Book of the Secrets of Enoch*, from a manuscript written in 1679 in a South Russian dialect; in 1886 Sokolov found in Belgrade an old Slavonic manuscript of the sixteenth century belonging to the same recension, generally designated as A. Novaković published in 1884 a Serbian manuscript of the sixteenth century, found at Belgrade, representing a different recension, known as B; of the same type are a manuscript in Vienna of the sixteenth century, collated by Bonwetsch, and a manuscript of the seventeenth century owned by Barsov in Moscow; a number of fragments, some of them as old as the fourteenth century, published by Tichonravov, Pypin, and Popov, also agree substantially with B. The relation between these two recensions has not yet been definitely determined. Charles and Bonwetsch agree in regarding A as more original, and B as an incomplete edition, though admitting many interpolations in A. The difficulty with this view is that B would then by accident, since intention is inconceivable, have left out just those passages and turns of expression that have been relied on to prove that the work was written in Greek by an Alexandrian Jew. Charles indeed maintains that some parts may originally have been written in Hebrew, but deems it impossible to separate these. The two recensions are perhaps most naturally explained if it is supposed that B is the first Slavonic translation, made from a Greek version of a Hebrew or Aramaic original, while A is a later Slavonic translation made

by one who had before him B, which he followed in the main, but also a different Greek manuscript which had been amplified by some Alexandrian copyist. There is nothing in the shorter recension that could not have been written by a Palestinian Jew about the middle of the first century A.D. Neither the silence concerning a Messiah, nor the reference to the world to come without the mention of a resurrection, militates against this conclusion. Christian interpolations have been suggested; but though the form of the Beatitudes and the ethical views here and there remind us of the Gospels, there is nowhere any distinctively Christian conception or expression. The same applies largely to the longer recension as well, which shows some traces of Alexandrian thought; influence of the Christian reasoning in favor of the eighth, i.e., the first, day in Barnabas xv, 4, may, however, be suspected in xxxiii, 1-2. The book was known to Origen. It is important because it gives a description of all the seven heavens, and even more so because it reveals an ethical development in some Jewish circles in Palestine, contemporaneous with, but independent of, Christianity, tending in the same direction. Consult: Morfill and Charles, *The Book of the Secrets of Enoch* (Oxford, 1896); Bonwetsch, *Das slavische Henochbuch* (Berlin, 1896), later than Morfill's, with a full description of the manuscript; Harnack, *Geschichte der altchristlichen Litteratur* (Berlin, 1897); Schürer, *Geschichte des jüdischen Volkes*, iii (4th ed., Leipzig, 1909); Forbes and Charles, *Old Testament Apocrypha and Pseudepigrapha* (Oxford, 1913).

**ENOCH ARDEN.** A narrative poem by Tennyson (1864). Its hero and title character is a shipwrecked sailor who finally returns home and finds his wife remarried. He leaves her to her new life, peacefully unconscious that her first husband is still alive.

**ENOCK, C. REGINALD** (1868- ). An English mining engineer and traveler. His best-known work is in his books on Latin America, which give excellent summaries of primitive history, conquest, wars for independence, and modern industrial conditions. Among his publications the principal titles are: *The Andes and the Amazon* (1907); *Peru* (1908); *Mexico* (1909); *The Great Pacific Coast* (1910); *Farthest West: Life and Travel in the United States* (1910); *The Secret of the Pacific* (1912); *Republics of Central and Southern America* (1913); *Ecuador* (1914).

**ENOMOTO BUIO**, ā'nō-mō'tō bōō'yō (1839-1909). A Japanese statesman, born in Tokyo. He was sent in 1860 to study in Europe. In Holland he obtained a solid training in science and naval practice and in 1867 he returned to Japan. After the final triumph of the Mikado in the civil war of 1867-68 Enomoto established in the southern part of the island of Yezo a republic, of which he was elected the President. In 1869 this government was defeated by the Imperial forces, and Enomoto was imprisoned in Tokyo. Released in 1872, in 1874 he was made vice admiral of the navy and was sent as Minister Plenipotentiary to Russia, where he negotiated the treaty for Saghalien. In 1882 he was Minister to China, and in 1885 he was made Viscount. In 1888 he became a member of the Council of State and Minister of Education, in 1891 Minister of Foreign Affairs, and from 1892 to 1896 was Minister of Agriculture and Commerce.

**ENOS**, ā'nōs (anc. *Enus*). The westernmost seaport of European Turkey, situated on a rocky isthmus near the mouth of the Maritza, in the Province of Adrianople, about 80 miles south-southwest of Adrianople and on the border line between Turkey and Bulgaria (Map: Balkan Peninsula, F 4). Its harbor is commodious, but much neglected and too shallow for deep-sea vessels. The trade, formerly of importance, has greatly decreased, Enos having been superseded as an export centre by the adjacent seaport of Dedeağatch (q.v.). The town is the see of a Greek archbishop. Pop. (est.), 7000-8000, principally Greeks. Homer attests the antiquity of Enos by alluding to it in the *Iliad* (iv, 519).

**ENRÍQUEZ GÓMEZ**, ěn-rē'kēth gō'mēth, ANTONIO, called in his early days Enrique Enríquez de Paz (1602-?1662). A Spanish dramatist, novelist, and poet, born at Segovia, the son of a baptized Portuguese Jew. He entered the army and had attained the rank of captain, when in 1636 he was obliged to flee to France to escape the Inquisition. In 1645 he dedicated to Louis XIII, whose major-domo he had become, the work entitled *Luis dado de Dios á Anna*. In 1660 he went to Amsterdam, where he afterward openly professed the Jewish faith. He was consequently burned in effigy by the Catholics of Seville. Before leaving Spain Enríquez had already acquired a reputation as a dramatic poet. According to his own statement, he wrote 22 comedies, of which *A lo que obliga el honor* has been regarded as the best. His other writings include: *La culpa del primer peregrino* (Rouen, 1644), a mystic theological poem; *El siglo pitagórico y Vida de don Gregorio Guadaña* (1644), a series of satirical portraits in mingled prose and verse; and *El Samson Nazareno* (Rouen, 1656), an abortive epic. His works will be found in part scattered through vols. xxxiii, xlii, and xlvii of the *Biblioteca de Autores Españoles*. Consult also J. Amador de los Ríos, *Estudios históricos, políticos, y literarios sobre los judíos de España* (Madrid, 1848).

**ENROLLMENT.** An entry upon an official or public register or record. In English law the term is applied to the registration of certain documents, such as a deed of bargain and sale, and the like, on the rolls of chancery or of the common-law courts, or by the clerk of the peace on the records of the Court of Quarter Sessions. The Statute of Enrollments, enacted by Parliament in the twenty-seventh year of Henry VIII (1536), as an addendum to the more famous Statute of Uses (1535), was a deliberate attempt to prevent the practice, to which the latter statute opened the way, of making secret conveyances of freehold lands by the process known as bargain and sale. It provided that no such conveyance should be valid unless it was enrolled, or recorded, within six months of its date, in one of the King's courts of record at Westminster or in the county in which the lands were situated. The manner in which this statute was evaded, by the invention of the method of conveyance called lease and release, is explained in the articles on **BARGAIN AND SALE**; **LEASE AND RELEASE**. See also **CONVEYANCE**; **REGISTRATION**; **RECORDING**.

In the United States the term "enrollment" is employed with reference to vessels engaged in the coasting and home trade, which are enrolled, while those employed in foreign trade are registered; and the words "registration" and "en-

rollment" are used to distinguish the certificates to those two classes of vessels. Enrollment applies only to the vessels engaged in domestic commerce and in voyages along the coast or in inland waters.

**ENS.** See **ENNS.**

**ENSCHEDÉ**, ɛn-skā-dē. A town in the Province of Overijssel, Netherlands, situated about 4 miles from the Westphalian frontier and 30 miles east-northeast of Zutphen (Map: Netherlands, E 2). The principal manufactures are cotton goods, thread, iron products, print goods, and electrical machinery. Over half the town was destroyed by fire in 1862, but it has been rebuilt. Pop., 1900, 24,353; 1910, 35,448.

**ENSCHEDÉ**, ɛn-skā-dā', JOHANNES (1708-80). A Dutch printer. He was born in Haarlem and educated in Leyden. As the head of the printing establishment founded by his father, Isaac Enschedé, he contributed greatly to the art of printing in his day. He introduced the type known as Holland Gothic. The first important specimen of printing types was issued from his establishment in 1768 under the title *Proef van Lettern*. The firm Johannes Enschedé en Zonen still exists in Haarlem.

**ENSEMBLE**, ɛn'sɛn'bl' (Fr., entirely). All the parts of a thing considered as a whole. Also the total, general effect produced, e.g., by all the figures or objects in a picture or other work of art, by the persons, plot, etc., of a drama or novel, or by the various parts of a musical performance.

**ENSENADA**, ɛn'sā-nā'pā. A port of Mexico, in the northern district of the Territory of Lower California, of which it is the capital (Map: Mexico, A 2). It is situated on the Bay of Todos los Santos, which affords a rather poor harbor. Its manufactures consist of leather, flour, candy, low-grade shoes, and some vehicles, mainly consumed by local trade. The town is the seat of a United States consul. Pop., 1910, 2170.

**EN'SIGN** (OF. *ensigne*, *enseigne*, ML. *insigne*, Lat. *insigne*, banner, from *in*, in + *signum*, sign). The national flag. In most foreign navies the man-of-war and merchant ensigns are different. In Great Britain the naval ensign has a white field, the naval reserve ensign a blue field, and the merchant ensign a red field. (See **FLAG**.) Ensign is the title of officers of the United States navy of the lowest commissioned rank. Midshipmen are commissioned as ensigns upon graduation from the Naval Academy. After service of three years as ensigns, all of which must be at sea, officers are promoted to the rank of lieutenant of the junior grade without regard to vacancies. The pay of an ensign is \$1700 per annum with an increase of 10 per cent after five years' service, including time spent at the Naval Academy. The number of ensigns on the active list in 1914 was about 700.

In military usage the title of ensign was formerly applied to the lowest commissioned rank in the British army. It also existed in the Colonial militia of New England and in the Revolutionary army of the United States. Ensigns were charged with the duty of carrying the regimental colors. The colors of a regiment in a sense stood for the regiment itself, embodying its history and always marking its headquarters. Officers and men were alike educated in their traditions and taught to regard them with so much reverence and affection that in return they frequently defended them with the utmost

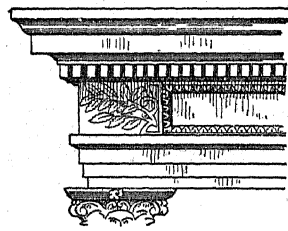
devotion and sacrifice. Modern strategy and battle dispositions render impossible their further use, the title of ensign having already been abolished in 1871 in the British army and the rank of second lieutenant substituted. See **COLORS, MILITARY AND NAVAL**.

**ENSIGN**, ɛn'sɪn, ORVILLE HIRAM (1863- ). An American electrical and mechanical engineer, born at Ithaca, N. Y., and educated at Cornell University. Between 1882 and 1893 he was employed as a machinist in Ithaca, and in various capacities was with the Schenectady Locomotive Works, the Edison United Company, New York, and the General Electric Company, Schenectady. For several years he was electrical and mechanical engineer of several railway and light companies in the region of Los Angeles, Cal.; in 1897, as superintendent and chief engineer of the Southern California Power Company, he planned and constructed the first long-distance 30,000-volt transmission line, and when this company became a part of the Edison Electric Company of Los Angeles he continued in the same duties until 1904. He then became chief electrical and mechanical engineer, and later chief electrical engineer, of the United States Reclamation Service.

**EN'SILAGE**. See **SILAGE**.

**EN'STATITE** (from Gk. *ἐνστάτης*, *enstatēs*, adversary, from *ἐν*, *en*, in + *στάτης*, *histanai*, to oppose, so called from its refractory nature). A magnesium silicate, crystallizing in the orthorhombic system, but usually occurring in lamellar or fibrous masses, sometimes with a submetallic or bronzelike lustre (*bronzite*). It has a vitreous to pearly lustre and in color is white or light yellow, gray or green. It is a common constituent of igneous rocks and by alteration may form considerable masses of serpentine. It is found in Moravia, Bavaria, the Harz Mountains, the Tirol, and in the United States in Putnam Co., N. Y. The fibrous varieties when cut frequently yield a cat's-eye effect and in consequence have some slight value as gem stones.

**ENTABLATURE** (OF. *entablature*, from *entabler*, ML. *intabulare*, to construct a table or floor, from Lat. *in*, in + ML. *tabulare*, to floor, from Lat. *tabula*, board). In architecture, especially of the classic and neoclassic styles, the cornice with the horizontal bands or members immediately below it. In Egyptian architecture it consisted of a torus, or roll molding, and a high cavetto cornice crowning the wall, or of an architrave or lintel and the torus and cornice crowning a row of piers or columns. In the classic styles each order had its special entablature, consisting of an architrave or epistyle, frieze, and cornice. (See **ORDERS OF ARCHITECTURE**.) In rare instances one of the two lower members is omitted; thus, in the caryatid porch of the Erechtheum the frieze is wanting, and in certain Renaissance and modern works the architrave is omitted. In Greek buildings, which were usually of one story, the entablature was the crowning feature; in Roman many-storied buildings with superposed



ENTABLATURE.

orders, the entire entablature was repeated over each order, forming decorative bands which expressed clearly the division into stories. In many Roman examples in which columns are engaged in a wall or pier or stand free in front of it, the entablature was made to project out over each column, being carried with less projection over the intervening wall spaces; this is called the "broken entablature." In late Roman work, especially in the provinces, the entablature was sometimes carried in a curve over the top of an arched opening (Spalato, Damascus, Baalbek, etc.). The Byzantine architects continued the use of the entablature of three members, and in Italy, and to some extent in southern France (Provence), it continued to appear in Romanesque architecture, disappearing with the advance of Gothic design. In Italy, however, it persisted through the entire Middle Ages, as on the baptistery and cathedral of Florence. The Renaissance revived the classic practice and types, which have continued in use ever since.

Any combination of horizontal bands and moldings resembling an architrave, frieze, and cornice is called an entablature, so that one may properly speak of the entablature of a pedestal, doorway, or piece of furniture. Consult Ware, *The American Vignola* (Scranton, 1910). See ARCHITRAVE; CORNICE; ORDERS OF ARCHITECTURE.

**ENTAIL'** (OF., Fr. *entailler*, It. *intagliare*, to cut in, from ML. *intaliare*, to cut in, from Lat. *in*, in + ML. *taliare*, to cut, from Lat. *talea*, cutting, rod). Any settlement or conveyance of an estate of inheritance whereby the legal course of succession is "cut off," one or more of the heirs at law being excluded or postponed, and the settlement of land made upon a particular heir or series of heirs. The first distinct trace of the existence of entails is found in the Roman law. The Greeks, indeed, permitted persons to name successors to their estates and to appoint a substitute who should take the estate on the failure of him first named. The substitute, as appointed, was permitted to succeed on the death of the institute (as he was called) without leaving issue or without alienating the estate. But this limited right fell far short of the power of entailing which has since prevailed in various countries. At Rome, under the later emperors, the practice of settling land upon a series of heirs by means of *fideicommissa* (see FIDEICOMMISSUM) grew up and was sanctioned by the state. This was originally simply a trust reposed in the honor of a friend, to whom the property was conveyed, to carry out the will of the grantor, but, like the trust of English and American law, it ultimately received the sanction of the law and was enforced by the courts. In their early form these *fideicommissa* contained merely a substitution of heirs. But by the later law a much fuller form of settlement was admitted, whereby the estate was protected

from every sort of alienation. It is impossible to doubt that this Roman form must have been adopted by the Scottish lawyers in framing their deeds of entail. There are, however, two points in which the Roman law differed from that which prevailed for many years in Scotland—viz., that the former did not . . . right of primogeniture, and that . . . of the deed was restricted to four generations. For the right of primogeniture, as . . . in deeds of entail, we are indebted to the feudal law. That system did not, in its original form, recognize the right of a holder of land to alienate his feudal benefice. But the right of the eldest son to represent his father, both in the duties and privileges of the fief, if not an original principle of the system, was universally recognized in the days of its greatest influence and extent. For a further treatment, see FEE TAIL. Consult the authorities referred to under REAL PROPERTY.

**ENTASIS** (Lat., from Gk. *έντασις*, distention, from *έν*, *en*, in + *τάσις*, *tasis*, a stretching, from *τείνω*, *teinein*, to stretch). Convex curvature applied to the upward taper of a column. In the Greek, Roman, and neoclassic styles the shaft diminishes in diameter upward, usually by about one-sixth of its lower diameter; but this diminution is so designed as to produce a delicately curved instead of a straight profile or outline. Although the curve is convex, at no point is the shaft diameter greater than at the bottom: the shaft nowhere *swells*, and columns made with a swelling outline are not of a truly classic type. In the Greek Doric the entasis begins at the bottom of the shaft; in the Ionic and in the Roman orders the lower third of the shaft is generally cylindrical, the entasis beginning at the top of this portion. Rules for laying out the Roman entasis are found in all the books on the orders of architecture (q.v.). The Greek entasis is more delicate than the Roman, and that of the Parthenon was not discovered until Cockerell's . . . early in the last century; the con . . . curve in these columns 34 feet high amounts to less than half an inch. Consult Goodyear, *Greek Refinements* (New Haven, 1912), and the article "Entasis," in Smith, *A Dictionary of Greek and Roman Antiquities*, vol. i (3d ed., London, 1890).

**ENTELLUS MONKEY.** See LANGUR.

**ENTENTE CORDIALE**, *ən'tānt' kōr'dyāl'* (Fr., cordial understanding). A term used specifically in international politics to signify a certain cordiality, based either on sentiment or on community of interests, between different countries and statesmen. It is not satisfied by the mere absence of strained relations and the maintenance of ordinary relations of international amity, but suggests a relation bordering on an alliance, though a formal alliance is by no means necessary to create it.

**ENTERIC FEVER.** See TYPHOID FEVER.













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